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1908

A Retrospect.

BEFORE closing the door on the year that has almost run its course, and passing out upon the paths of an unknown future, we will, as is our wont, take a glance backward. We enter upon a new year without any definite notion as to what it is going to bring forth. It is a providential law that relieves humanity from a foresight of much of the distressing—aye, and even of the joyful—circumstance of life. Did we but have complete foreknowledge, there is much that we should dread and hesitate over, but which, when it arrives in (as it were) an adventitious manner, we meet with greater courage than might otherwise be the case. We look back over the paths that have been travelled during the past year. How few of us anticipated at the opening of the year much of the incident that now lines those closed paths. The year has been significant in its national and industrial happenings. There have been changes the importance of which it is impossible to assay. Parliament has been busy in building up financial responsibilities for the future, and in scattering additional burden alike upon all classes of the community. Labour has been conscious of a continued unusual opportunity, and has not been idle in taking full advantage. The Socialist demagogues have likewise, opportunists that they are, found the conditions favourable to the nurturing of their peccant doctrines; while, on the other hand, the gas industry has exhibited a remarkable expansion in adhesion to the one famous system that is destructive of the mischievous methods of Socialism, but by rational means simultaneously attains the same ends and more—social and moral advancement, provision for old age, surety of industrial peace, and happier relations between capital and labour, with mutual confidence. We cannot write of such powerful effect from a single scheme without permitting a pause in the enumeration of feature to mention the irreparable loss that stands apart from all else with solemn and gloomy distinction in the industry's records of the year. The opportunity for scattering the seeds of discord and discontent during the year and demoralizing the workers of the country has been broadened by the condition of the country's trade, which has been crumbling away despite the desperate effort at restraint. It is an ugly reflection of this condition of trade that the last-issued Board of Trade returns present in the reduction of 99 millions sterling in our foreign commerce over the period of eleven months—£53,539,401 decrease in imports, and £45,644,857 in exports. In the period, there was a falling off of £57,644 in the exports of coal, coke, and manufactured fuel, of £182,638 in iron ore, scrap iron, and steel, £109,615 in other metallic ores, £8,963,350 in iron and steel and manufactures thereof, and £2,796,035 in other metals and manufactures.

The year for the gas industry has had its bright features and its troubled and dark ones. Though the condition of commerce has been universally bad, and the gas industry has suffered in common with the general contraction of trading scope—while coal contrary to precedent in such times as these has remained dear, while taxation and rating have continued their repressive influence, while the burdens of industrial life have not in any degree been relaxed, and while the mildness of the year (especially of the latter part), and the slackness of trade, have not conduced to expansions in the demand for gas or coke—the industry has, with the statutory protection enjoyed, been among the least of the sufferers. The financial tale for the whole year has to be completed at the February and subsequent meetings; but meantime the statistical records published this year are such as to give us all the greatest satisfaction. The Board of Trade returns relating to gas undertakings—referring in the case of statutory gas companies to 1906 and in the case of local authority gas undertakings to 1906-7—divulged progress and an altogether agreeable state of prosperity. It was September before these returns were published; and the delay gave rise to much inconvenience. It is hoped the Board of Trade will take steps to hasten the appearance of the documents in future, remembering in the present that twelve months have already passed since the close of the gas company year and nine months since the close of the local authority year which will afford the material for the next issue of the returns. However, the last published returns incorporated in their pages 763 statutory undertakings, whose year's receipts amounted to the goodly sum of £28,009,330. The coal requirements of these undertakings in the year amounted to 14,846,257 tons; while the total make of gas was 181,841,076,000 cubic feet, of which 167,945,206,000 cubic feet were sold—the total output representing an increase of 6,936,285,000 cubic feet. These are illuminating figures, proving a remarkable vitality in the face of competition. Were further official testimony demanded as to the financial and commercial standing of the gas industry, attention might be directed to the report issued in the autumn by the Commissioners of Inland Revenue, by which one would be impressed with the fact that, in the year ending March 31 last, the gross income assessed in respect of gas-works in the United Kingdom, based on the profits of the preceding year, was £1,735,084 (or 31 per cent.) higher than in the year 1897-8—the figures being £5,582,771 and £7,317,855 respectively. Compared with 1905-6, there was a decrease of £95,756. This only shows how much better would have been the return in favour of progressive prosperity had the coal and other expenditure in 1907-8 been of a normal character.

With such a stout financial position, with such splendid history at the back of the industry, no small wonder that joint-stock gas undertakings continued throughout the year to be held in high esteem by investors—in fact, the evidence of this accumulated in the course of the year until the close, when gas stocks and shares for the greater part (trade depression notwithstanding) stood somewhat higher in their market value than at the beginning. Of course, during the year, the market for gas securities has been subject not only to the influences arising within the industry, but to those external ones that spread their effects without respect or favour in the financial world. We will not on this occasion refer particularly to the many influences that cause oscillations in the Money and Stock Markets. Suffice it that observation within the limits of the gas industry shows that, for the most part, while the variations with an exception or two in the quotations of stocks and shares have not been large, prices are higher than a year ago; and this is spread pretty evenly from Metropolis, through the Suburban concerns, almost generally to those operating in the Provinces. Most of the leading Continental gas stocks which are dealt with here, and the same with the more distant stocks, show improvement—not much, still improvement. But the shadow of the condition of affairs at the Cape is reflected in the quotations of the stocks representing the capital employed there. Looking at our quotations of home gas stocks, in about 38 of them small increases have been recorded, eight have remained stationary, and some 25 are slightly lower than they were a year ago. The ordinary stock of the Gaslight and Coke Company, which in December last stood at £92-£94, is to-day seven points higher, at £100-£101. The Imperial Continental Gas Association's capital stock records a rise of 13 points. The "A" stock of the Tottenham and Edmonton Gas Company has risen 13 points (though the quotation for this for some time was manifestly only nominal); and the West Ham Gas Company's ordinary stock shows an appreciable rise since the announcement of the Gaslight and Coke Company's Amalgamation Bill. Several new issues of gas capital have been made during the year by auction, and fairly considerable parcels of gas securities have been sold by trustees, executors, and private owners. Prominent among those who have been concerned in the sale of these under the hammer have been Messrs. A. & W. Richards. Throughout the year, this firm have found the demand very steady; and,

with one or two trifling exceptions, there have always been plenty of buyers forthcoming to absorb the gas stocks and shares they have submitted.

Turning with satisfaction from the high position held by the gas industry as a centre for safe investment, there may be a light survey of the year's internal affairs, and some of the more salient features affecting the operation of gas undertakings. As a glance is made over the mass of intelligence given in our pages during the year as to the course of events in connection with the business of gas supply, one is struck by the world-wide character of the news. In the periodical gas literature of no other country is there such a collection of information relating to the commerce of gas supply. In the news accumulated, we start at home, proceed to near and distant European countries, away to India and the far East, to the Antipodes, to South America, and to Africa. The secret of it all is found in the links forged by British capital and enterprise, by the high place held by British manufacturers in the supply of gas plant, and by the ties of kinship with our Colonies. But wherever we look, in certain respects the features of the year appear to have an almost world-wide similitude. Coal—the British varieties being the favourites for gas making, and exportation going forward on the large scale—had, through the higher figures at which contracts were made in 1907, a marked effect upon accounts, in the first half of the year, both at home and abroad, and gas-works abroad using English coal had also to bear freightage higher than that which is regarded as about normal. But the coal owners may take it that the export business for gas coal has now about seen its top level; for now that illuminating power is losing ground as a necessary property of gas, in view of its use in incandescent burners, for cooking and heating, motive power, and other industrial purpose, the disposition abroad is to make the best use of the lower quality of coal that lies near at hand, so save freightage, and assist local industry. If such coal can be obtained cheaply with low transmission costs, though the volume of gas per ton is not so good nor the illuminating power so high, its use may be, and is found to be in certain cases (Calcutta for example), both admissible and economical. However, coal is a difficulty of the first part of the year that has been ridden over safely to the easier condition achieved by the new contracts entered into in the spring and early summer. While the year has again produced its influx of new consumers, and additions to the numbers of cooking and heating stoves and other applications, gas consumption in many places did not proceed in the first part of the year at the old rates of increase, and in the second half of the year much the same thing has prevailed. In London there were small percentage increases in consumption in the first six months; but in the second half of the year we are expecting to learn that, while in some weeks there have been increases on corresponding weeks, decreases in the remainder will show on balance a loss of consumption. The incandescent burner, the long and bright summer, bad trade, short hour working and reduction of hands in factories, and the persistent mild weather at the close of the year, have all operated for a fall in the rate of increase. But there are some developing districts where such conditions as these are rather to be welcomed than otherwise; for when, in times when conditions should repress, percentage increases of 7, 8, 9, 10, and even above the last figure are booked, the flights of consumption, without the checks imposed by atmospheric and trade conditions, would, to say the least, often be somewhat inconvenient. Exceptional increases during the past year are in most cases an indication of exceptional local circumstance, and nothing else. Take the suburbs of London for example. There are undertakings that have been making percentage increases such as those quoted without interruption; while neighbouring undertakings have been merely accumulating volumes of increase, representing 2, 3, or 4 per cent., and perhaps less than the 2. We go farther afield, and see the same diversity of experiences in the Provinces; and what with shipbuilding, cotton, and other trade disputes in the North, supplemented by the general weakness of trade, it will be found that the year has produced a variable experience all round. The influence of trade conditions on gas supply is also seen by the reports that came from South Africa during the year, where an oppressive cloud has hung over industry for a long time, but is now it is hoped lifting—however leisurely. In connection with the question of business development, the first meeting during the year of the amalgamated Bromley and Crays Gas Company, provides an illustration of the movement (which will be pursued in the coming session of Parliament) in the annexation of small gas undertakings by the larger and more solidly established ones—the larger undertakings conferring the protection and economies of their greater business upon the district of the smaller concern, and the district of the smaller concern offering a fresh field in which to exploit the lower priced gas. In this way there is mutual and progressive advantage.

It has been a matter of no small satisfaction to find that so many undertakings were able to tide over the 1907-8 peak of high coal prices without raising the price of gas; but this ability rested almost entirely on the strength of the undivided balance and the reserve fund, and upon the price charged for gas. Some companies who managed to work at their old charges during the second half of 1907 under the high-priced contracts, found it necessary to raise their price in the first half of this year. But the somewhat lower prices at which coal contracts were entered into in the spring, fortunately enabled in most cases a retracing of steps in this matter in the second half of the year, or notices of reduction for the beginning of the coming one. The process of lowering prices has been carried on as keenly by municipal authorities as gas companies.

We will not individualize companies or local authorities in this connection; but there are a few features associated with the Gaslight and Coke Company and the South Metropolitan and South Suburban Gas Companies that have taken prominence in the year's history. The reformation in the policy of the Gaslight aud Coke Company since Mr. Corbet Woodall succeeded to the Governorship has been justified to the full. The work of rehabilitation has gone on without a break; and the accounts and general position of the concern to-day exhibit a condition of affairs that the most optimistic had not allowed themselves for several years preceding the change to dream as being within the range of possibility. In what has been done, the Governor has been loyally supported by his colleagues, the chief officials, and the staff. The improvement of affairs is traceable from the carbonizing department throughout the gigantic business. For what has been done on the works, part of the praise must heartily be accorded to the Chief Engineer and the Station Engineers. There is no indication yet as to the tale the accounts for the current half year will have to tell; but having regard to the conditions of the six months, there will not be surprise if, though fresh consumers and new stove, fire, and industrial connections have been booked with unbroken constancy, the consumption of gas shows a slight percentage recession. But the position of affairs when the proprietors met in August last was that, while meter-rents had been re-established, bringing in about £60,000 a year, a reduction to which consumers had long been strangers had been made in the price of gas, which (though only a 1d.) represented to them collectively about £80,000 a year; and the hope was held out by the Governor that the Company would be in a position to concede a further 1d. at the beginning of the coming year. If this hope is fulfilled, the price will then be 2s. 9d. per 1000 cubic feet. The proprietors, too, received an extra dividend at the rate of 2s. 8d. per cent. There are also indications that, possibly by the close of another six months, the great army of workmen will be sharing in the rewards of an enlightened administration by being taken into partnership. If this is consummated—the South Metropolitan Company and the Commercial Gas Company being Co-Partnership Companies—the people of London will have something for which to thank the Gas Companies in assuring through this means that the important service of gas supply to London shall be free from the menaces and effects of labour disturbances. One perplexing feature of the accounts for the first half of the past year was the augmentation of the unaccounted-for gas by 1 per cent., which 1 per cent. is equivalent to a considerable volume of gas. The announcement was made the subject of publicity by the press sensation mongers—the "Lancet" alone among technical papers coming out with a dire account of the evil effects of unaccounted-for gas on delicate and highly susceptible humanity. In their account our medical contemporary exhibited its ignorance as to "unaccounted-for" and "leakage" not being synonymous terms in relation to gas supply. The world wags on as usual; and notwithstanding the portentous rigmarole of the "Lancet," there has been no apparent increase of physical or mental debility among the people of London, nor have the mortality statistics shown any upward flight due to carbon monoxide poisoning. However, leaving that,

a final note regarding the Gaslight Company is that they are bent on extending their business operations by absorbing, on agreed terms, the West Ham Gas Company—if Parliament and the shareholders consent.

The final speeches on administrative topics that Sir George Livesey made to the proprietors of the South Metropolitan and South Suburban Companies, and through them to the gas industry generally, evinced the continued keenness and great mental calibre of the lamented leader. But there has been sorrowful occasion to deal with these matters so recently that we will not dwell on them here. As to the general affairs of the larger Company, the increase of 3d. in the price of gas (to 2s. 3d.) has been justified; and the consumers have not complained. The accounts have shown an improved front in consequence, though insufficient recognition has been made of the strength of the Company in the lowness of their price, the solid character of their reserves, the large stockholding in the concern of workmen and consumers, and other features that are the attributes of stability. The February meeting of the Company was marked as the occasion of a now celebrated attack on the system of rating and the fees of valuers and professional witnesses. But over this question we will draw the veil, and let subsequent events stand as recorded in our pages. At the August meeting, Sir George made out a good case showing how internal efforts and successes in administration and working are negatived by external influences, which external influences mean additional money burden which swallows the economies of the persistent endeavours of those responsible for the management and working. Taking these matters into consideration, it is the expressed intention of the Board of the Company that in future they are going to adhere to the letter and spirit of the sliding-scale by only reducing the price of gas (having arrived at a good position in this respect) when the proprietors can participate in the improved position to the prescribed extent. During the year, Mr. Frank Bush, the late Secretary, was placed on the Board, and Mr. F. M'Leod succeeded him in the Secretaryship. On the death of Sir George, Mr. Robert Morton ascended to the chair; but only temporarily until Mr. Charles Carpenter was elected a Director by the proprietors, and then was invited to take the chair. Mr. Carpenter has also been elected a Director of the South Suburban Company. A subject of general interest was raised at the February meeting of the latter Company, when Sir George spoke his mind on the subject of retaining directorships and fees when physical infirmity prevents proper attention being given to the interests of an undertaking. Referring not specifically to any one Metropolitan undertaking, it may be mentioned that the London County Council, in the course of the year, called attention to the amount of sulphur other than sulphuretted hydrogen in the gas distributed; but there are evidences of continued improvement in this respect, and of the prospect of still further betterment without reverting to lime purification. Heavier charges in the old systems of carbonization, or the use in due season of vertical retorts, point to ways of reduction.

There has been reference to the stability of the gas industry in an earlier paragraph; and before leaving Metropolitan gas affairs, we should like to point to a statement that Mr. W. M. Mordey, the President of the Institution of Electrical Engineers, made in his address to members of that body. It was that taking the population of the County of London at 4,685,000, the total number of units of electricity sold per head per annum (lighting and power) is 37·3, and the total revenue per head 9s. From calculations we have made, it is found that the total gas consumption per head of the population in the County of London—taking the total gas sold in 1907 by the Gaslight and Coke, South Metropolitan, and Commercial Companies—is 8198 cubic feet. The total revenue from all sources is equal to £1 8s. 11½d. per head, or for gas alone (ignoring meter and stove rental, residuals, and miscellaneous receipts), £1 0s. 6¾d.

The prepayment system of gas supply continues its progressive career in prosperity; and this system and cooking-stoves are responsible in these times for a large proportion of the capital that, with greater frequency than not a great number of years since, gas companies find it necessary to raise, and investment in which is engaged in with confidence by the public. But those associated with the old-established gas industry, jealous of its good name, do regard with fear and considerable resentment the introduction of audacious gas promotions, which are used in the most scandalous way for sucking money from the public, and leaving the concerns strained and stranded with a load of capital which they are incapable of carrying—much to the disgust of those who have been allured into investment by the prospectuses speciously drawn by the ringleaders in this new form of money-making on the reputation of the industry. The unfortunate thing is that the loosely-phrased clause 10 of the Companies' Clauses Act of 1845 permits the acquisition by these men of lists of shareholders in well-established undertakings, simply by one of the promoters, or one of their "companies" through which this scandalous business is being conducted, or one of the underlings of the promoters purchasing a small holding in a concern. We cannot think but that this is a contortion of the intention of the legislators of 1845, and that there was no thought of giving facilities to people who carry on a vicious business of this kind. Resistance has been offered in Court to certain such promoters securing lists of shareholders or stockholders by the Gaslight and Coke Company, the Brentford Company, and the Chigwell and Loughton Company; and the two latter Companies shook the applicants off for a time through flaws in their procedure. The Gaslight and Coke Company had Justice Warrington against them on a mere interpretation of the clause of the Act, which, he held, conferred a privilege, without power to inquire into motives for the exercise of that privilege. The Company are now appealing. A new phase is imparted to the question by Mr. H. D. Ellis, who has in our columns raised the point as to the clause not applying to holders of stock; and reference to his article a fortnight since will show that he is not without some foundation for his contention. One nest of promoters has been broken up. The history of the Kent County and West Suburban promotions has been completed. There were sorry tales to tell about these concerns when Mr. Registrar Hood inquired into the promotion and failure of the former, and when the Uxbridge Gas Company (the Chairman of which is Mr. H. E. Jones), on wiping out the latter Company by purchase, let light upon the rascally methods by which the public were duped and robbed. The promoters of these two concerns were known as Lawson and Co., but they have become notorious as Gyde and Darby. Among their promotions were certain Slate Quarries in Wales; and the Public Prosecutor laid Gyde (which is another alias) and his brother, Marcus Bernard, by the heels for fraud. But Darby has absconded. Gyde left the Central Criminal Court sentenced to five years' penal servitude, and Bernard to a year's hard labour; so that their villainy is ended for a time. However, against the wiles of promoters, gas shareholders should be freely warned. The invitations of the former to subscribe for capital are couched in the most ingenious form. There have been several disclosures during the year as to the rottenness of certain of these concerns.

Much that has already been said about the gas-supply business applies equally to municipal undertakings as to privately capitalized and administered ones. Of all municipal trading that which is concentrated in gas supply has least that is offensive about it. It is conducted with spirit, and conducted ably, where the Committee placed in charge are willing to give their chief technical officer the triple *rôle* of guide, philosopher, and friend, and deal with his recommendations in a considerate, yet prudent spirit. There are two blots on the muncipal management of gas-works, of which evidence comes all too frequently to hand. One is the hypercritical and domineering attitude of certain councillors, with inflated heads and scant knowledge (who cannot see themselves as others see them), towards their officials, and the continued appropriation of gas profits in aid of the rates, and therefore in aid of municipal concerns that are in less prosperous condition. The inequality of this form of taxation, the unfairness of one class of the community relieving the rates of those who do not contribute to the making of the profit, are among the arguments that cluster about this controversial question. Parenthetically, it may be remarked that, while this is bad enough, we do not want to see the German idea of a gas and electricity tax introduced into this country. However, Alderman Gibson of Manchester has continued, in the interests of the gas consumers, to agitate this matter of the appropriation of gas profits; and we have been glad during the year to see that there has been a spread of the opinion among the members of local authorities that the proceeding is an iniquitous one. In the year the matter has been discussed in several council chambers; and we hope the champions of equality in municipal responsibility, financial and otherwise, will persist in

their campaign until they win a majority conclusively to their way of thinking. Widnes consumers have had a further proof of their wisdom in refusing to allow the Council, as was proposed in the Corporation Bill of last session, to take from them the position they enjoy, of having the profits devoted to the purposes of the undertaking or to the cheapening of the gas. The reduction made a few months ago has brought the price to consumers of over 3 millions down to 1s. per 1000 cubic feet, under 3 millions to 1s. 2d., and for power to 1od. This shows the sound economic policy of devoting profits to the purposes of the undertaking. Cheapness of every municipal service without recourse to the rates should be the aim of every local governing body. It is an interesting fact that in the Potteries Federation Act of the past session, a clause insists that the gas and electricity consumers in the combined area shall be supplied by the new Council without profits being made. Little has been heard during the year of the further municipalization of gas-works; but in the coming session of Parliament, there will be a slight revival. In certain council chambers, there has been much small talk over the equally small topic of moderate expenditures by Committees in paying the disbursements of deputations to inspect new works and improvements. The resurrection of the penny wise and pound foolish policy is obviously associated with the greater progressive and socialistic representation in much civic polity. Several Local Government Board inquiries for new gas loans have been held during the year, which is one of the evidences of expansion; and this reminds that not a few municipal authorities have taken the advice of the President of the Local Government Board (the Right Hon. John Burns) to so regulate useful work and loans that employment may be found for the unemployed when the austerities of winter or bad trade are upon us. He is absolutely opposed to special local relief work, counting it as anything but an economic proceeding. For the rest in relation to gas supply, it is interesting to note that the greater number of municipalities are at one with companies in seeing that the mutable methods of gas utilization have brought greater liberty to gas production; and they have taken advantage of it. Fourteen candle gas and the modern means of testing for illuminating power are becoming as common among local authorities as among companies. Edinburgh is a notable example of this; for during the year the successful application to Parliament to authorize the distribution of gas suitable to modern requirement has made considerably bigger the rift started by Glasgow some years ago in the conservatism in this respect of our Scotch friends.

The competitors of gas supply in the shape of private producer and suction-gas plants have made progress during the year both in efficiency and in adoption. But the experience of those who adopt suction gas is not altogether so satisfactory that, on all hands, extension is favoured. The time lost in starting-up and in valve-cleaning, the irregularity of the quality of the supply, which means irregularity in working efficiency, the several stoppages that occur through mishap, and the many nuisances created, have shown manufacturers that the costs put forward by makers are not so comprehensive as a faithful balance-sheet demands, and that a stand-by supply from the town gas-mains is a desirable and, in fact, necessary adjunct to suction-gas plant. But as yet gas companies have not obtained from Parliament the same protection that electricity supply has in being allowed to make special terms for such stand-by supplies. Power gas distribution has not, from the experiences of the South Staffordshire (Mond) Gas Company, advanced in favour during the year; and many are the people who are now of opinion that "a failure" is the proper word to write over the door of that concern. The Power Gas Corporation, Limited, have been in the Courts this year in connection with a reduction of capital from £350,000 to £300,000. These competitors, which claim kinship to town gas supply, will, there are signs, lose ground through their own deficiencies, and more particularly if gas suppliers continue on the course of work they have set themselves, to produce gas of good character in thermal units at a low price. There is also the electrical competitor, about which there would be little to complain if private enterprise directed its commercial destinies, and municipal pampering and mismanagement were not so much in evidence.

The unfair conduct of municipal electricity in competition with gas is a matter into which the Committee of the Gas Companies' Protection Association announced at the last meeting they were going to inquire. The sooner the better. But competition and the commercial side of the gas industry are matters to which more than ordinary attention has been devoted, during the year, at meetings of the District Associations and the Junior organizations—in both Presidential Addresses and papers. The most recent was at the Southern Association, when there was much said, prompted by a paper by Mr. Ebenezer Pye, on combined advertising and other methods in connection with the further popularizing of the use of gas and the meeting of the gas-vilifying process of conducting the electrical campaign. The subject is not a new one, having been raised by Mr. F. W. Goodenough at the Dublin meeting of the Gas Institution. It is hoped that the matter will not be permitted to sink again into oblivion. The value of organized commercial work, and of spreading agency and the points of business transaction, have been exemplified in several ways. The Commercial Sections in connection with the District Associations, which started with the Manchester District Institution, have gained greatly in favour—the Eastern Counties and the Southern Associations having now established similar sections. In the district of the latter there have also been local commercial gas organizations formed—namely, the South-West and the Cornish—on the lines of the successful one in the Isle of Wight. The plan of entering into business relations with local ironmongers has been extending itself, after the manner of the arrangements in operation in, for example, the districts of the Gaslight and Coke Company, the South Metropolitan Company, and the Croydon Company. Early in the year, it was learned that 77 ironmongers had then entered into arrangements with the Gaslight and Coke Company, and the net value of the stoves they had dealt with, on behalf of the Company, was £2510, and for £1400 of which amount seven of the ironmongers had been alone responsible. In connection with this subject of commerce, we cannot refrain from special mention of the excellent address delivered to the American Commercial Association by Dr. A. C. Humphreys on "Efficient Commercial "Management;" and to the one by Sir George Livesey, in his capacity of President of the Society of British Gas Industries, on "Buyers and Sellers." This Society, by the way, had, according to the report presented at the spring meeting, 55 firms enrolled as members.

Conjoined to this commercial question, is that of publicity by way of exhibiting. Local exhibitions are not so frequently heard of now as they were a few years ago. They have an excellent temporary effect in giving a spurt to business; but, on the whole, the permanent show-room in a prominent situation is much to be preferred, when managed in spirited fashion, and made the centre of trading activity. But during the year, a popular demonstration of the uses of gas—for lighting, heating, cooking, power, and industrial purposes—was made at the Franco-British Exhibition, under the direction of a Committee, of which Mr. H. E. Jones was Chairman, representing gas-supply undertakings, from whom upwards of £4000 was collected for the purpose. Active in connection with the organization of this display were Mr. James W. Helps, Mr. D. Milne Watson, Mr. F. W. Goodenough, and Mr. E. Pilbrow; and, as the Engineer to the contracting Company for the gas supply, Mr. Alex. A. Johnston did excellent work. About the exhibition, gas was used for multifarious purposes—largely in the catering departments and for power (especially in generating electric current) and other industrial objects. In the grounds of the exhibition, the first large display was made of the Keith new high-pressure inverted gas-lamp, which, with London gas, returns 60 candles, or rather more, per cubic foot of gas consumed, and with lower illuminating power gas in Germany nearly 55 candles. Mainly through the energy of Mr. W. R. Herring, gas was also well to the fore at the Scottish National Exhibition in Edinburgh—many of the modern gas-lamps being on view.

The Commercial Sections of the District Associations to which reference has been made are found to be excellent channels for the private communication of matters that are useful in the settling of contracts with gas undertakings; and when the value of the sections is still more recognized, they may play a further important part in guiding policy. Concerted action would often be found of advantage—in, for example, the purchase of coal. Before hardly a thought had been given by many gas administrators, at the beginning of last year, to the question of coal contracts, one of the coal papers asserted that the Gas Coal Federation were taking action to defeat what were discourteously called "the "machinations" of gas companies, and that it was fully

expected "the collieries would unite in insisting upon an "advance of 2s. or 2s. 6d. per ton on 1906 prices," which was merely a reduction of 1s. or less per ton on those of 1907. Then in March the same paper announced that the coal-owners had reaffirmed their intention not to accede to anything less than 2s. 6d. per ton advance on 1906 prices. The spirit in which this resolution was arrived at was practically a declaration of war on the gas industry, which is one of the largest and most constant customers of the colliery owners. The audacity of the proposal, in face of the rapid decline of trade, would have been humorous if it had not contained in it an intimation of impending trouble in settling contracts upon a reasonable basis. The collective determination did not hold good, for contracts were commonly made thereafter at a reduction of 1s. 6d., and in some cases 2s., below the 1907 prices; and the course of trade has shown that the colliery owners were somewhat out in their calculations as to the strength of their position. The Yorkshire and Derbyshire colliery owners burnt their fingers seriously in holding out their hands for prices that were foolish in their extravagance. But the colliery owners of Yorkshire and Derbyshire have learned the lesson from which Durham had previously profited, that the gas industry can better now than aforetime buy where it likes, and favour can be shifted about and bestowed with comparative ease. Certain gas undertakings have, instead of entering into contracts this year, been buying—we believe right up to now—at their leisure in the open market. They have found ready and willing sellers, and have lost nothing by what has been termed the "waiting policy." In our issue for Feb. 18, it was shown how abundantly the coal owners profited by the removal of the export duty. It has also been seen that the total coal exports in 1907 reached nearly 64 million tons, which was an increase of 8 million tons on the previous year. But there has been a decline this year. At the beginning of the year, our Northern coal trade correspondent quoted Durham gas coals at from 12s. 3d. to 14s. per ton f.o b., according to quality. In the last issue, he was talking of 9s. to 10s. per ton, with 10s. 9d. for specials.

From all of which it will be recognized that the conditions for a further reduction next contract season are favourable. Judging from the position of affairs at the moment, the coal owners will be more eager to secure contracts than the gas industry will be to place them, except on a moderation of present terms. There is no doubt, however, that the coal owners will make the most of the Coal Mines (Eight Hours) Act, and try to use it as a lever for getting the last possible penny. This Act is the final piece of mischievous work of the past session. It will be remembered that for all coal-fields, except those of Durham and Northumberland, the Act will come into force next July—the time that deliveries under many new contracts will commence; but for Durham and Northumberland, on Jan. 1, 1910. This piece of legislation has from the first met with severe opposition from all quarters other than from the coal miners; in its promotion and passing, the Miners' Federation and the Government having been in collusion. Miners' wages being governed by coal prices, it is a measure that will bring a little advantage to a comparatively small section of the community, and an infinity of damage to the remainder of the community and to the country's welfare generally. The Institution of Gas Engineers, the Gas Companies' Protection Association, and the Society of British Gas Industries did their utmost in protesting against the measure; and Sir George Livesey, Mr. Corbet Woodall, and Mr. H. E. Jones led in the almost general chorus of denouncing that came from the chairs of gas undertakings. Several gas companies, too, worked against the measure through the Coal Consumers' Defence League, and by circularizing Members of Parliament and their shareholders. What the coal owners thought of the measure and the extra burden that it would inflict was indicated by the proposal to insert in contracts a clause providing for an increase of 1s. 6d. per ton in the event of the Bill passing into law and becoming operative before the contracts expired. However, the opposition did some good, as, at the instance of the House of Lords, the eight-hour day was made to exclude windings, and not include them as it was proposed by the Government it should do at the termination of five years. This will serve to mitigate the effect of the statutory restriction of the hours of labour in mines; but it is a pernicious measure.

The higher cost of coal—that is to say higher than the normal—has not been compensated by the position of the residuals market. Certain gas undertakings amid specially good conditions have been able to maintain a good price for coke, but following the lead of coal, and the continuance of mild weather, there has been a slipping back—by shillings in cases—from the prices that ruled at the beginning of the year, and some rather large stocks—larger than is usual at this period—are lumbering up certain gas-works' yards. The end of the year compared with the beginning shows lapses in the market prices of tar and sulphate of ammonia, and in regard to the latter nitrate is in the same boat. Looking at the secondary products, there is hardly an item that has not suffered shrinkage—in cases, most serious ones. The annual report of the Sulphate of Ammonia Committee testified to unabated activity in disseminating knowledge among agriculturists as to the manurial value of the commodity.

The question of tar is always with us. It has had frequent repetition in our pages during the year. Intelligence has come to hand from various parts of the country of experiment and greater use for road purposes; and this all augurs well for the future. The more it is talked about, and the more it is used, the better. There has been a road conference in Paris, where tar was voted the best possible substance for preventing dust nuisance and trituration of road surfaces by motor car traffic. The subject also had prominence at the meeting of the Sanitary Institute at Cardiff. It could not, however, be expected that there would be plain sailing without some obstacles to extended use in this direction. A report came from Paris in the summer that the tarred surfaces along the boulevards were responsible for killing trees, plants, and other vegetation; but the report was afterwards shown to be unfounded. Then the Local Government Board took a somewhat high-handed proceeding in surcharging the Settle Rural Council with one-third of the cost of doing some tar-spraying, which cost had been agreed with the West Riding County Council. The Local Government Board were of opinion that the spraying did not amount to an improvement. We do not remember seeing the result of the appeal that the Rural Council decided to make. But all the energy in the use of tar for road purposes does not result in the absorption of sufficient to make any effect on the tar item in the accounts of gas companies. The output of tar goes on apace; and so it comes about that attention is occasionally also directed to other new outlets for its use. One reader of a paper before the Société Technique this year was advocating its use for the heating of regenerative retort-settings, and information was given in our pages from the Bulletin of the United States Geological Survey as to its use for briquette binding. The question of tar distilling was raised at the meeting of the Eastern Counties Association by Mr. John Young; but neither the paper nor the discussion gave much encouragement to, at any rate, small undertakings going into the tar-distilling business, particularly where there are tar distilleries at hand. By a paper read before the Canadian Gas Association, it was seen that the Dominion suffers the common experience of low prices for this gas-works residual.

As a division between the review of the commercial affairs of the industry and its technical work, a few references may be made to the parliamentary, legal, and labour events of the year. In the early part, there was a disruption of parliamentary proceedings by the retirement and subsequent death of the Prime Minister, Sir Henry Campbell-Bannerman, who was succeeded in his high office by Mr. Asquith. But in its main features, the year's legislative work has been a failure. Bills that have succeeded in which there has been interest for us have been the Old Age Pensions Bill, the Coal Mines (Eight Hours) Bill already referred to, and the Port of London Bill. These have been commented upon from time to time from the position of their effect upon the gas industry. A point that came to the front in connection with the Old Age Pensions Bill was the disability of the House of Lords in the matter of amending a Bill that could in any way be brought within the category of a financial measure. They can either accept or reject; so that to a large extent, in a Bill of such great national and social importance, the constructive legislative ability of the Lords is curtailed. The Port of London Bill (now an Act) will chiefly only affect, through the dues, the gas undertakings that use the Thames for the conveyance of goods. There was a strong effort to secure protection and certain exemptions for the gas undertakings concerned, in view of their being *quasi* public services; but there was little consideration given to their representations—in fact, in committee the Companies, it seemed to us, were treated in rather curt

manner. There is an innovation in the Act in respect of compulsory land purchase, experience with which, if favourable, may lead to facilitating generally the acquisition by statutory concerns of sanction to purchase land—the sanctioning authority being the Board of Trade. Here, again, this is a matter discussed as recently as last week, so that there is no occasion to dilate upon it now. There was an inquiry during the session in regard to the greater utilization of daylight, and consequently the lessened use of artificial light; the matter being raised on what was called the Daylight Saving Bill. A Committee favourably reported on the matter to the House of Commons; but the Prime Minister declined to give facilities for carrying the measure into law. During the discussion, opinions were divided as to whether the measure would really be detrimental to purveyors of artificial illuminating agents; but as there were estimates of substantial savings put forward by factory owners and railway companies through lessened requirements for artificial light, it may be taken that such savings cannot be made by buyers without loss in the selling quarters. A Bill was introduced by Lord Avebury to accord the municipal franchise to joint-stock companies. It had a second reading in the Lords, but was then maimed by the refusal of the Government to support it.

It is high time that something was done to lighten the expenses of Private Bill procedure; and if the Gas-Works Clauses Act were brought up to date, it would be something towards economizing time and trimming down expenses. The Board of Trade during the year have done a little towards mitigating the expenses attending Provisional Order procedure, and to make this method of securing parliamentary authorization more attractive. The Society of British Gas Industries petitioned the Board on this subject, pointing to the hundreds of private gas-works that are operating in this country, whose useful service might be expanded if Provisional Order procedure were less costly. During the session, the Parliamentary authorities showed how dead-set they are against innovation without it is of their own devising; but there is not always agreement that what the parliamentary authorities devise is the best under the circumstances. The special purposes fund clause, which supersedes the insurance and renewal funds, in Gas Acts is a case in point. It has its objectionable features. It would not be a bad thing if the parliamentary authorities would allow their amending propositions to be subject to the scrutiny and criticism of outside authorities before making the changes. The new auction clause is a totally different matter. It is a useful and sensible modification of the old one. There were not many gas promotions in the past session; but quite a number of them asked for a lower illuminating power standard—some for as low as 12 candles. But 14 candles is the standard consistently inserted in Bills by the authorities, tested by the Carpenter "Metropolitan" No. 2 burner.

This dropping to the lower standard proceeds, notwithstanding the fact that our old friends Mr. Thomas Newbigging and Mr. Isaac Carr have, during the year, issued warnings against what they regard as a shocking retrograde movement on the part of the industry. But the gas profession and experience are both against them. It was a very bitter pill for the little force of would-be obstructives (though that is not how they regard themselves) when the Edinburgh and Leith Gas Commissioners, in the home of the higher illuminating grades of gas, received parliamentary sanction to conform their practices to the English methods in this regard. There is no reason why, now that Parliament and the Board of Trade have repeatedly sanctioned the No. 2 burner, it should not be applied generally throughout the country; and we wish the Gas Companies' Protection Association success in the movement made to get the Board of Trade to take up this matter. The Committee of the Association are waiting now for an appointment for an audience with Mr. Winston Churchill. The subject of the use of the "Metropolitan" No. 2 burner stirs up at intervals a little correspondence, by those who, animated by a rigorous honesty, desire in some mysterious way to make certain that consumers get the advantage of its use. The consumers, however, have ample protection under the sliding-scale, where applied; under competition, where it is not. Keenly interested was the gas profession in the contest between the Draycott and Long Eaton Companies over territory in which both held powers of supply. The Draycott Company had long served the district; the Long Eaton Company had long neglected it. Both Houses of Parliament decided in favour of Draycott; and Long Eaton stood deservedly condemned for their tactics in this matter. The Bromley Gas Bill absorbing the Crays Gas Company went through; as did the Derby Bill taking over the Belper and and other small gas-works.

Among other notable schemes endorsed by Parliament was the federation of certain towns in the Potteries under the name of Stoke-on-Trent, and the electricity scheme for a district near Dublin, in connection with which peat is to be used for the production of gas, and the gas for driving engines for the generation of the electricity. Our interest in the Potteries Federation Scheme centred itself in the position of the gas supply. The London and District Electricity Bulk and Power Supply Bill failed in the Commons. But during its progress, the Brentford Company essayed to get protection for their mains, but there rose the ancient cry that the general legislation sufficed. A Bill from the Finchley Council proposed a small supply of electricity outside the administrative area of the promoters. Certain gas companies asked for the Northumberland clause in connection therewith. This was refused in the House of Commons; but the Lords took a more prudent view of the position, and gave the promoters the choice of the clause, or confining operations to their own administrative area. Their preference expressed much; it was to be free of the Northumberland clause. The linking-up Bills of London electricity suppliers went through safely. The Coalite Company promoted a Bill to authorize them to supply gas for power purposes in East London. They dropped it for two reasons: One the wise conclusion that Parliament would not authorize such a proposal; and the other because the proposed Electricity Power Company for London entertained the idea of erecting their generating-station next door to the coalite plant at Barking, and were contemplating using the gas for engine driving. The rejection of the Electricity Bill leaves the Coalite Company still looking for a customer for gas that nobody wants, and nobody cares to take from philanthropic motives. The notices for next session's Gas Bills give more promise of life; but the principal measure will be that of the Gaslight and Coke Company for annexing, under agreement, the West Ham Gas Company.

The "Legal Intelligence" of the year contains several very interesting matters, if not really imposing cases. There were echoes of the rating appeals of the year before. Chief in importance of all decisions was that of Justices Channell, Bray, and Sutton, in an appeal against the judgment of the Recorder of Ipswich; their Lordships holding with the Recorder that prepayment meters, stoves, and fittings are just as much chattels (and not part of the hereditament) as ordinary meters, and therefore should be regarded as tenant's capital on which a deduction should be made. This decision was hailed with gratification by gas men the country through. The Edinburgh and Leith Gas Commissioners appealed against their assessment of £94,393 in respect of the city of Edinburgh. The Town Council, sitting as a Valuation Court, upheld the valuation; but the Commissioners asked for a case to be stated for the High Court. One peculiar question raised in this instance is as to whether, in calculating the capital value of the undertaking, the value of the ground in which the pipes are laid should be added to the capital value. Three nuisance cases arising from gas-works occupied attention. There was the pollution of a brewery well at Edinburgh through liquid leakage from the gas-works; a settlement being arrived at on the footing of defendants paying pursuers £4600 and costs. The South Suburban Company were hauled before Mr. Cecil Chapman, one of the Metropolitan Police Magistrates, in connection with a complaint as to the disposal of the tank water of two gasholders undergoing extension. The Magistrate agreed with the Company that they took the best known and most practicable means of avoiding nuisance during the emptying operation. The Liverpool United Gas Company were summoned in connection with a smoke nuisance from the Wavertree works. An abatement of the nuisance resulted in the withdrawal of the summons. An interesting point was raised by the Brentford Gas Company over their test-burner. Their Act of 1868 merely stipulates for the use of a 15-hole argand, with 7-inch chimney; and the Company claimed that they could use a modern burner so long as it complied with this prescription. The Local Authorities and Magistrates wanted to tie the Company down to something crude and antiquated. But the Lord Chief Justice and Justices Darling and Sutton held that the Company are entitled to modern improvement in this respect. The decision is favourable to many gas suppliers throughout the

country. The Local Authorities in the Brentford district have been taking counsel together to see whether the aid of the Legislature cannot be invoked to alter the position of affairs. We have not heard whether the movement is being pursued; but, if the authorities are wise, they will let the matter drop. Of current interest is the litigation there has been over the supply of shareholders' lists—a matter to which reference has already been sufficiently made in an earlier part of this survey of the events of the year. There have been cases of liability in connection with escapes of gas or explosions, and bearing upon compensation to workmen for injuries resulting from accident. But these are matters that have each to be decided on its own particular circumstances; so that specific reference need not be made. There have been three or four instances of lapses from the path of integrity by gas officials; and punishment has been awarded by the law. Among them William Harris, the head bookkeeper of the Chorley Gas Department, received a sentence of three years' penal servitude; and worse still Robert M'Vicar, the late Chairman of the Ayr Gas Company, has been found deserving of seven years' penal servitude. The differences between motor bus and lamp-post owners regarding damage done to public lamps by the butting propensities of motor cars have been before the Courts; and, as the matter stands at present, the onus rests on the motor bus owners of proving, when damage occurs, that reasonable care was exercised in driving. Of prepayment thefts, there has been the usual batch. This is a growing evil. Many thousands of these meters are broken up in London yearly, as witness the last half-yearly accounts of the South Metropolitan Gas Company; and reports come from all over the country as to the prevalence of the trouble. The money taken is perhaps not such a serious feature, regarded merely as a loss; but the cost of removing and repairing the damaged meters is another matter. Some newly designed strong boxes have been described in the course of the year.

Labour topics have already received mention in connection with the Old Age Pension Act (which comes into operation on Jan. 1), the Coal Mines (Eight Hours) Act, and with other matters that have been brought incidentally into the review. Here and there in the country there have been little disagreements regarding the question of wages for certain classes of gas employees; but they have been amenable to settlement. In Dublin, at Christmas time last year, some of the men tried to embarrass the management by striking. They did not succeed, and were glad to return to work at the beginning of the new year on the same terms. There was a threatened strike at the Stockport Gas-Works on account of the dismissal of a unionist, but not because he was a unionist. Abroad there have been strikes at Rio de Janeiro and Budapest. In the former case, the Company did not experience any difficulty; and they easily found men to take the places of the malcontents, who soon returned to work on the old terms. At Milan there has been spasmodic trouble with the men; and the uncertainties of labour are great there. "Try co-partner-"ship" is the advice that Mr. Walter Hunter (one of the Directors of the Commercial Gas Company) tendered to the Directors of the Continental Union Gas Company at the last meeting of the proprietors. Gratifying indeed was it to Sir George Livesey in the latter months and days of his life to see, after his many years of persevering endeavour, co-partnership taken up so influentially in the industry apart from the Companies in which he was chiefly concerned; and not the least of the satisfactory incidents of his declining days was when, two to three months before the end, he was able to write welcoming the public appearance of Mr. Corbet Woodall at his side in furthering the great and beneficent system. Enrolled under the co-partnership scheme during the year have been (alphabetically stated) the Bournemouth, Croydon, Gloucester, Leamington, Rugby, Tottenham, Tunbridge Wells, Walker and Wallsend, and Wrexham Gas Companies; and, just before the year closes, it has been learned that the Gaslight and Coke Company have been giving serious consideration to the scheme, and that ere long the intelligence will possibly be received of its definite application. Through Sir Christopher Furness, the scheme has been adopted, on less liberal terms than the co-partnership gas companies have conceded, in the shipbuilding yards with which he is identified. The Right Hon. A. J. Balfour has lately been pleading the cause as a powerful social and industrial movement.

Several gas-works have also been showing larger interest in the technical instruction of their workers; and the Gaslight and Coke Company have entered (on their own initiative) upon a scheme with the London County Council, whereby boys are trained as fitters in special shops provided by the Company, and, during training, receive technical instruction appropriate to their craft at one of the Council's schools. Loyalty to King and country has been shown by numerous gas workers joining the Territorial Forces; and commendable assistance in this matter has been rendered by gas administrators and officers. The usual labour conferences were held during the year at which the customary series of fantastic resolutions was passed; but in labour circles a great shock has been inflicted by the decision of the Court of Appeal that the payment of Labour Members of Parliament out of Trade Union Funds is illegal. As previously said, there have been a few workmen's compensation cases in the Courts this year. In this connection, those who want a useful compendium of the law of workmen's compensation cannot do better than consult the paper presented by Mr. Thomas Berridge to the Southern Association. An inquiry was instituted, and the result published during the year, as to the best mode of insurance by gas undertakings against accidents to workmen. The inquiry was by a Committee of the Institution; but it did not lead to any beneficial result so far as the exorbitant demands of the insurance offices went. The Committee advise setting aside a fund, with, in the case of small companies, the adoption of a modified form of insurance, whereby there would be insurance against fatal accident and permanent incapacity. Conciliation and arbitration were effectual up to a point in composing labour differences. An event of the year, however, was the Board of Trade memorandum setting up a fresh and permanent tribunal for settling labour disputes by arbitration, if required by the parties.

It will not be necessary to linger long over the work of our technical organizations during the year. There has not been anything of really conspicuous importance. But little by little the responsibilities in recording their work increase. The home organizations—what with the Institution, the several District Associations, and the Junior Associations—produce a mass of material that, with the claims of other intelligence and movements, makes heavy demand on the scrupulous recorder of the industry's doings. The proceedings of the Continental gas organizations are also reported; and review is made of the proceedings of the American Institute and the State Associations. Australia in recent years has given birth to a technical organization, whose proceedings are forwarded to us by Mr. P. Holmes Hunt. This year we have given welcome to the new Canadian Association; and the proceedings at the first annual meeting have been reported. Science knows no limits; nor does intercommunication between the work of the world's gas organizations. For instance, feelings would be fearfully outraged in this country if the English gas periodicals closed their pages to the carbonizing work proceeding in Germany. However, it is impossible to review all the great collection in our pages of technical literature, and no one would thank us for doing it. Briefly, then, be it said that the meeting of the Institution of Gas Engineers, under the presidency of Mr. W. Doig Gibb, was eminently successful. The four most notable points about it were: It was the last meeting of gas engineers at which Sir George Livesey advocated co-partnership. The proceedings were made peculiarly instructive by Professor Bone's erudite delivery on combustion and the thermal decomposition of hydrocarbons; and, in connection with the question of carbonization in vertical retorts, by the papers of Mr. A. F. P. Hayman and Mr. Harold Woodall, and the joint report by Dr. H. G. Colman and Mr. A. E. Broadberry on an investigation in Germany of the Dessau system. A paper that has given rise to much controversy was read by Mr. F. J. Bywater, on "Refractory Material." The masters in the fireclay centres decline to agree with all Mr. Bywater's conclusions; but they have practically admitted that there is room for the proper training of men in the industry, and the better understanding of the nature and peculiar properties of the raw material on which they are called upon to work.

The Carbonization Committee of the Institution and the Sub-Committee on the Economical Application of Gas for Heating Purposes (the latter working in conjunction with the Leeds University) have not yet got far enough with their researches to report on the subject. The annual meeting of the German Association was also largely occupied with matters concerning carbonization in vertical retorts and the

Munich chambers; and the Société Technique papers were principally—though not entirely—devoted to questions subsequent to carbonization. While alluding to the Continental Gas Associations, it is worth noticing that during the year there were published in our columns reports regarding the work of the experimental plant of the German Association, of the State laboratory for the testing of fuels at Zurich, of the experimental plant of the Swiss Association of Gas and Water Engineers at the Zurich Gas-Works, and of the laboratory at the Magdeburg Gas-Works. There is nothing yet in the nature of an experimental plant erected for the common behoof of the British gas industry; and there are no indications of anything of the kind coming along. One of the principal topics of discussion in American gas circles has been that of photometry and the standard of light; and it will be a most hopeful step towards universal gas photometry if America, as there is the promise, adopt the British (pentane) standard. The British Association assembled this year in Dublin; and in the course of the proceedings much was said about producer, suction, and peat gas, but very little about coal gas. The new rivals of town gas do not lose an opportunity of getting a place on a platform; the coal gas industry loses several. There are, however, two or three distinguished professors who could be deputed to keep up the end of coal gas before scientific bodies if proper steps were taken.

The Senior and Junior District Associations of this country all put on record an amount of useful work; and an excellent feature of the proceedings of the juniors, which we have strongly encouraged in the past, has been the numerous visits paid to works. It is good for the juniors to be brought as much as possible into contact with the work of the seniors under varied conditions. The Junior Associations also united in paying a visit to London, where they inspected several manufacturing works connected with the industry, and visited the Franco-British Exhibition, at which they were addressed by Mr. H. E. Jones. Talking of the Juniors, naturally reminds of technical education and examination. The Fuel and Gas Engineering Department of the Leeds University has commenced work; and in connection therewith special lectures are being arranged to be delivered by Dr. Harold G. Colman and Mr. Walter Hole. It has been decided that the industry's memorial to Sir George Livesey shall be the endowment of a Livesey Professorship of Gas Engineering and Fuel at the University of Leeds. The Technological Examinations of the City and Guilds of London Institute entered upon their new phase this year so far as the gas candidates were concerned. The development is in the severance of distribution from gas manufacture and engineering. The examiner in the latter was Mr. A. F. Browne, and in the former Mr. J. H. Brearley. The results of the examinations were excellent; and there are indications that the distribution examinations will become highly popular, and that the certificates will be vastly helpful to candidates for appointments in the distribution departments of gas undertakings. Intending candidates will find great value in the questions set in the first distribution examination and the specimen answers published in our pages—the two articles being written by one who is in a position to give useful information.

A feature in the history of technical gas organizations this year has been the reciprocal evidences of good feeling that have been raised to the surface by organized visits. Many members of the Institution travelled to Berlin, with the main object of inspecting the Dessau vertical settings at Mariendorf and Oberspree. Their reception and the hospitality extended to them by their professional friends of the German Association and by the Imperial Continental Gas Association were marked by great cordiality and munificence. The visit was, in fact, one that will have abiding remembrances for all who were fortunate enough to be able to undertake the journey. On our part, reception was appropriately given to the members of the Société Technique at the Franco-British Exhibition—the Gaslight and Coke Company, Mr. Corbet Woodall and Mr. H. E. Jones, the Institution of Gas Engineers, and the Bournemouth Gas and Water Company severally taking (and they took it well) the *rôle* of hosts. How much our visitors enjoyed themselves is shown by the impressions outlined in our report at the time, and by the fervent acknowledgments of M. Coze, the President of the Société, of M. Godinet, the President-Elect, and privately of other members.

The allusion to the question of carbonization that has been made but faintly points the remarkable amount of contribution to our pages in the course of the year on the Dessau vertical retorts, the Woodall-Duckham continuous system of carbonization in vertical retorts, the carbonizing chambers at Munich and Hamburg, and coke-oven working generally. Interesting as the subject is, it would require considerable space to indicate the features of the mass of contribution. Körting, Hayman, Woodall, Colman, Broadberry, Holgate, Forbes Carpenter, Drehschmidt, and many others have been among the contributors, and these names stand for thought and quality of judgment. Confirmation of experiences have been given, and practices have been attacked; and there is the evidence of much need for a thoroughly systematic investigation. There is to be a setting of 60 retorts on the Dessau system at Sunderland, and of 36 Woodall-Duckham retorts at Burnley—in productive capacity, the latter representing a greater installation than the former. But these installations will supply us with valuable information under British working conditions. The Dessau system has received large adoption in Germany; and one of the incidents of the year was that Herr Klönne contested the validity of the patent, but did not succeed. The Young and Glover vertical plant at St. Helens, it is expected, will soon now be giving some working account of itself; and Mr. Thomas Glover's three-feet deep retorts at Norwich are accumulating results under ordinary working conditions. There is interesting news in store.

The advocates of the system of bye-product recovery coke-ovens have continued to urge upon the gas-supply industry its benefits, as their interested eyes see them, for gas production purposes; but the men responsible for the technical work of the British gas industry have as yet failed to appreciate the advantages, for their particular purposes, of carbonization in such heavy bulks; and German trials with chambers and big retorts, using lighter charges, have not given results that prompt conviction. The utilization of coke-oven gas has, however, been to the fore. Mr. C. H. Merz introduced it in a paper before the Iron and Steel Institute; showing that there is profit in employing it for driving gas-engines for the generation of electricity. Mr. J. Mogford, before the Welsh Association, suggested its utilization by gas suppliers; and an interesting experience came to light, in the discussion, of the utilization of the gas in the supply of a few hundred prepayment consumers. In Indianapolis, gas is now being supplied from coke-ovens; there being no stipulation as to illuminating quality, but a calorific power standard of 600 B.Th.U. is specified. This is following the lead of Boston, Baltimore, and other places in the United States.

During the year, there have been some fresh outbreaks of effort by the Coalite Company at stirring up enthusiasm. There has been plenty of fresh talk as to prospects, the achievements are skilfully stated on paper, but the financial prospects are nebulous to the extreme. People whose knowledge of the gas industry and of carbonization is remote, aided by the eloquence of Professor Vivian B. Lewes, have been telling the carbonizing experts of the gas industry that their system is wrong and wasteful, and that a reversion to low-temperature carbonization, lower than has ever been the practice before, is the correct thing. Thankfulness for this gratuitous counsel, we fear, has not been shown in a particularly hearty manner. Something more than paper estimates and an invitation to enter a highly speculative market, even when Professor Lewes is retained to issue the invitation, is desired by the gas industry before leaving the paths along which triumphant commercial progress has been made. But there is promise, according to the belief of the Coalite Directors, of all that is desired from the plant that has been erected at the Plymouth Gas-Works. The gas industry is quite content to wait. For the present, the sketch of the position of the coalite business in recent issues may be taken as being about accurate.

Quite a number of new works and extensions have been described in the course of the year; and, in connection therewith, allusion may be made to the unique series of articles by Mr. Maurice Graham under the title of "Round "the World, and Some Gas-Works." Never before has there been such a publication. The articles have brought before us, in graphic and interesting style, the features and local circumstances of gas manufacture in distant climes. Connected with gas-works plant, some special features described have been Mr. Thomas Glover's three-feet deep horizontal retorts, the new Feld washer, Dempster and Toogood's system of rope-drive for projectors, the starting

of the 10 million cubic feet holder at the Manchester Gas-Works, and the four-lift spiral-guided holder with a capacity of 3,100,000 cubic feet for the Newcastle and Gateshead Gas Company. In the distribution department, the question of the utilization of high pressures has been frequently discussed in papers and articles.

The question of public lighting has claimed a large share of notice—chiefly due to the unreasonable and impolitic manner in which municipal authorities who own electricity undertakings deal with the matter. The object is, where the gas supply is in the hands of a company, to oust at any cost gas lighting from those streets in which cables are laid. Economy and efficiency and rational illumination are points that are thrown to the winds—Marylebone, Tunbridge Wells, Hastings, and York being illustrations. In connection with the revived agitation of municipal electricity departments for a larger share of the street lighting in the central town areas, the question of the voting power of councillors who are gas shareholders has again been brought forward; and Mr. F. E. Cooper, the Secretary of the Gas Companies' Protection Association, has twice, in our columns, this year shown that such councillors are not debarred from exercising their representative rights to the extent suggested. The witness of high-pressure lighting in the City of London, Berlin, Westminster, and other places, has been efficiency and constancy in all weathers, and at reasonable price. Christmas saw the start of the Keith high-pressure inverted 1500-candle power lamps in Fleet Street, each lamp using only 1000 cubic feet of gas in 40 hours. Inverted lamps of the low-pressure type have also continued to prove their excellence for street illumination. On the side of gas, every year brings fresh testimony of reliability; on the side of electricity, every year brings its crop of failures and darkened streets, shops, and houses. Reliability is an essential unrecognized by many local authorities for public lighting purposes. The automatic method of lighting and extinguishing street-lamps has been gaining ground.

Considering the extent of the gas industry, there have been comparatively few accidents of sufficient importance to be recorded. A dozen in all will not be far from the mark; and in them fortunately the personal injuries sustained have not terminated fatally in more than perhaps half-a-dozen cases. Two or three explosions have occurred in works; purifier operations have been interrupted by personal injury; but, among the fatalities, the most gruesome was the crushing of a man to death in a coal-breaker at the East Greenwich works. Something like a dozen gas explosions in distribution areas have been recorded; and about the same number of gas suffocations which could not directly be traced to suicide. In these cases, imperfect fittings and loose taps were the prominent cause, which point to negligence. If a beer-tap becomes loose, immediate steps would be taken to remedy it; if a gas-tap works loose, nobody seems to care. A gas-fire was responsible for death in one case, or rather the insane manner of fixing it. The fire had been set in front of an ordinary fireplace completely filled in with boards, and the gas supply taken from a gas-bracket. The year has been an extraordinary one for suicides by gas—the total roll of which we have had information reaching to 38 lives.

This review has already extended to great length; and the points that it had been intended to make on the position of lighting, cooking, heating, and industrial applications must now be passed over with the remark that progress continues. Manufacturers of appliances are persevering in exercising their abilities to good advantage in producing efficiency and meeting new requirements; and much has been done—Dr. Rideal's investigations may be quoted as an example—in the defence of gas against the aspersions of competitors. There has been no lack of information on all these subjects.

Concerning personal matters, there has been a fairly considerable change in official circles. Among retirements from official life have been Mr. Henry Hack, Mr. Frank Bush, Herr Leonard Körting, Mr. A. C. M'Minn, Mr. T. H. Martin, and Mr. Levi Monk. The resignation has also taken place of Sir Frederick Mappin from the Chairmanship of the Sheffield Gas Company; and he has been succeeded by Mr. Wilson Mappin. As mentioned elsewhere, Mr. Charles Carpenter has ascended to the Chairmanship of the South Metropolitan Gas Company and to the Board of the South Suburban Company; meantime also retaining supervision over the affairs of his old office as Chief Engineer of the former Company. To succeed to any position occupied by Sir George Livesey is an honour. To the Board of the South Metropolitan Company, Mr. Frank Bush has also been elected; Mr. F. M'Leod following him in the secretaryship. Some of the chief appointments of the year include Mr. W. Anderson, to the Hanover engineership, Mr. F. J. Bancroft, to Barnet; Mr. T. H. Beaumont, to Portland; Mr. J. W. Buckley, to Hornsey; Mr. L. J. Langford, to Abertillery; Mr. James M'Leod, to Greenock, in succession to Mr. William Ewing, resigned; Mr. C. B. Newton, to the engineership of the Hull Corporation water and gas supplies; Mr. Samuel Tagg, to the Preston engineership, and Mr. W. Newbound to the secretaryship; Mr. James Taylor to Mossley; Mr. John Terrace, to Great Grimsby; Mr. W. Tervet, to Devonport; and Mr. Cyril Towers, to Brentwood. Mr. J. H. Hill has been confirmed in his position as Secretary and Manager of the York Gas Company. Mr. Frank Livesey has obtained the appointment of Assistant Engineer at Maidstone; and Mr. Walter Grafton, that of Assistant-Manager at Glasgow, in succession to Mr. James Lowe, who has gone to Auckland. It is interesting to notice the success of Britishers in gaining appointments abroad. Mr. A. Clement Hovey has gone to Milan, Mr. J. Carter Moon to Vancouver, Mr. F. G. Cockey to Bahia (to take charge as Chief Engineer of the gas and electricity works of the Bahia Tramways and Light Company); and Mr. J. H. Willoughby to Santos, Brazil. To take up the work of Deputy-Engineer to the Australian Gas Company, Mr. Andrew Wilson has left home; and as assistant to the Engineer of the Buenos Ayres (New) Gas Company, Mr. J. H. Darrah proceeds to South America.

The dread Reaper has been busy; and the year 1908 will stand as a dark one in the industry's annals. It was a heavy blow, causing universal and profound sorrow in our ranks from top to bottom, when the sad news came that the friend, benefactor, and strenuous worker for the industry, Sir George Livesey, was no more. His laurels are many; for his work had been great, his successes numerous and influential, and he had won a place in the hearts of men that few can ever hope to attain. His achievements unite themselves into an everlasting memorial of his remarkable and well-used gifts and qualities. But in other ways his memory is to be preserved after his contemporaries are no more; and, chief among the means adopted, as already stated, is the endowment of a Livesey Professorship of Gas Engineering and Fuel at the Leeds University. Singular it is that within a few days of each other, Mr. Henry Green and Mr. H. B. Green, father and son, passed away; similarly Mr. Walter Fiddes and Mr. Walter William Fiddes, father and son, died within a short space; and within the past week or so Mr. and Mrs. Thornton Andrews. Our deepest sympathy is with the relatives. Among other men who have held place in the industry, and who have been called away during the year, are Mr. W. J. Warner, Mr. T. N. Kirkham (one of the Engineers of the old Imperial Gas Company), Mr. C. W. Jones (Rome), Mr. H. J. Mitchell, Mr. G. Rankin Love, Mr. Robert S. Carlow, and Mr. Robert Good. The loss of M. Alphonse Salanson, the President of the Union des Gaz, is one that is greatly deplored by his colleagues. Other men whose work has, in the various paths they trod, been of value to the industry, but who have departed, are Mr. Francis H. Wenham, the inventor of the Wenham regenerative shadowless lamp, Mr. B. H. Thwaite, and Sir Ralph Littler.

Here the retrospective work must end. It will have been seen that, despite adverse trading conditions, the industry has maintained its high position in the commercial world and the confidence it enjoys in the realm of finance. In consolidating position, there has been material progress; and the work directed to the gathering in of fresh sheaves of improvement in plant and appliance has not gone unrewarded. Everything is a success, no matter how small the result, if the result is described by the terms "economy" or "efficiency." We start the fresh year looking for lower coal prices, and hoping for that improvement in trade that will benefit the country and labour, and, at the same time, bring advantage to our own industry in larger gas business and better prices for residuals. At the moment, however, existing conditions are not such as to encourage great expectations. But nevertheless things must be in bad case if one cannot wish, as we do most heartily, all friends

A Good Measure of Prosperity and Happiness

in the Coming Year.

MRS. B. H. THWAITE FUND.

READERS of the "JOURNAL"—to whom, of course, he was well known, either personally or by reputation—will be pained to learn that by the early death of the late Mr. B. H. Thwaite his family has been so inadequately provided for that help is urgently needed. The long illness which preceded his end involved heavy expenses he could ill afford; and his widow has collapsed under the added burden of the final shock. The malignant disease for which she underwent a terrible operation some few years back has reappeared; and she is quite unable to face the future without substantial succour for herself and her two young children—a boy of eight and a delicate girl of fifteen. The circumstances of the case were laid by some friends before Mr. Carnegie, who has promised the sum of £500, conditionally on a like sum being subscribed by others. An influential Committee has, therefore, been formed to endeavour to collect an amount which, with Mr. Carnegie's conditional £500, would provide a fund for bringing up and educating the two children and meeting Mrs. Thwaite's immediate wants.

The Hon. Secretary to the fund is Mr. W. H. Booth, of No. 2, Queen Anne's Gate, S.W., who has forwarded the following appreciation of Mr. Thwaite, to indicate why a ready and generous response should be made to the call of his family in distress—a call which we feel confident will not be made in vain.

"Over 200 patents lodged by Mr. Thwaite attest in a concrete form some of the workings of his busy brain; but his thoughts comprehended a range of subjects astonishing to the average mind. The honour of being the first to prove that waste blast-furnace gas could be utilized in the cylinder of an internal combustion engine, is his absolutely. It might be said that here is a striking case of brain energy multiplied into an infinite sum of mechanical energy; and some of us who realize from the strides made in other countries what it will some day mean in our own, feel proud that another British name has been added to those whose labours pointed the way to further economy in our iron-producing industry—creating a field for big gas-engines.

"The latest available figures show that one firm of large gas-engine makers alone have built since 1902, or now have in hand, 247 engines aggregating 308,000 H.P.; and in Germany the power now generated by blast-furnace gas in gas-engines cannot be far short of 1,000,000 H.P., if, indeed, it does not exceed that figure. In Belgium, also, there have been great developments, as well as in the United States, where one works alone—the Lackawanna Iron Company—have some 45,000 H.P. of blast-furnace gas-engines at work. Great Britain has lagged somewhat behind; but there is now steady progress being made towards the fulfilment of Mr. Thwaite's hopes, which in Germany have been more than realized.

"He reaped no adequate monetary reward from the patents he took out; and his attempt to build up a business by supplying plants was made in the face of appalling difficulties. Gas-engines of even 200 H.P. were rare, due to the existing limitations of town and producer gas; and having no works, he was ill-equipped to rectify the mistakes in design inevitable in the first serious engine units he contracted for. When English and foreign firms, having every resource of capital and workshop equipment, also experienced many costly failures in their early installations, in justice to Mr. Thwaite his far greater handicap must be realized. The financial support he received was altogether insufficient to cope with his task, but was generous when considered as given by one man—Mr. F. Gardner, who, incidentally, was neither an Englishman nor a technical man. The progress since made, however, is a triumph for all who have been concerned in building up the business to its present colossal proportions. Mr. Thwaite was considered by many as a dreamer when he outlined the far-reaching probabilities that lay in his conception. But the first explosion of blast-furnace gas in the cylinder of the little engine that Mr. James Riley put at his service in the Glasgow Iron and Steel Works, was the beginning of an ever-increasing series that may be likened to a world-fusillade doing Mr. Thwaite honour."

We urge upon our readers the appeal of the Committee to engineers and business men to come forward promptly in order to provide the funds necessary for Mrs. Thwaite's immediate and urgent needs, and to bring up and educate the two young orphans. The Committee are anxious to make an early demand upon Mr. Carnegie's conditional promise.

Institution of Municipal Engineers.—A general meeting of the Institution will be held at Caxton Hall, S.W., on Saturday, the 16th prox. Mr. John T. Pegge, City Engineer and Surveyor, of Durham, who has been elected President of the Institution for the year ending June 30 next, will deliver his address; and four papers will be submitted for discussion. Two of these are on "Street Lighting in the Smaller Urban Districts," by Mr. Edgar F. Willson, Surveyor to the Epping Urban District Council, and the "Status and Subject-Detail Appertaining to the Duties of the Twentieth Century Municipal Engineer," by Mr. Frank Latham, Borough Surveyor of Penzance. "Scottish Municipal Law and Administration" will be dealt with by Mr. John A. MacLeod, Burgh Surveyor and Water Engineer of Girvan, and "Road Management and Repair," by Mr. John H. Evans, District Main Road Surveyor to the Hertfordshire County Council.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 922.)

THERE was nothing about last week to regret on the Stock Exchange, except perhaps one—that was that it was too short, being curtailed to four days. For, in spite of the progressive closing-down for the holidays, which lopped business shorter and shorter, the tone was so cheerful, and prices in most lines were so uppish, that it was a pity not to have six days' enjoyment of what one does not get every week. There was, almost of course, one regrettable exception to the bright list—viz., Consols. But even they were a fraction better at the close than at the opening. The rest of the gilt-edged division opened quite well on Monday, sustained by investment orders. Home Rails continued to keep their heads up for reasons already well known. Dock stocks were thought worth buying on the terms of the parliamentary bargain; and Mines attracted some speculators. The favourable conditions continued on Tuesday; and the firm tone was aided by the absence of any alarming news from the Danube. Business was much reduced by Wednesday. Railways were a little set back by profit snatching—an operation long a stranger in a market where there have been no profits to snatch. South Africans were in favour; and things in general were firm. On Thursday, business was comparatively active for Christmas Eve. There was a good demand for choice investments, and the week had a pleasant close. In the Money Market, there was a good steady demand. Discount rates developed an easier tendency. Business in the Gas Market was about a fair average. There was hardly any change in values; and the few movements were slight in degree. In Gaslight and Coke issues, the ordinary was unchanged in quotation; but actual prices were very slightly easier—ranging from 99½ to 100¼. A little was done in the secured issues; the preference changing hands at 106 and 107, and the debenture at 84½ and 85½. There was not much doing in South Metropolitan; but the price was firm—dealings ranging from 119½ to 120½. In Commercials, there was one bargain in the 4 per cent. at 106¼. In the Suburban and Provincial group, Bournemouth "B" was marked at 16⅞, Brentford old at 247, ditto new at 190, Brighton original at 210 (a rise of 1), Tottenham "A" at 136, ditto "B" at 106½, and West Ham at 112½. The Continental companies were very quiet. Imperial was a point weaker, at from 179 to 180⅜, ditto debenture made 96, Union preference 137½, and European fully-paid 24 and 23⅞. Among the undertakings of the remoter world, Monte Video changed hands at 11½, Primitiva preference at 5½, River Plate at from 13⅛ to 13 5/16, and San Paulo debenture at 50¾.

ELECTRICITY SUPPLY MEMORANDA.

On Metallic Filament Efficiencies—London Electric Shares—A Big Blaze—Municipal Electricity Trading: What has the Future in Store—Inefficient Electricity Representatives—A Gas Consumer who Requires Attention—Lights of the Church.

BEFORE the Rugby Engineering Society, Mr. J. Findlay has read a paper on the incandescent electric lamp, in the course of which it is found that he does not altogether agree with the efficiencies that are frequently claimed by electricians for metallic filament lamps. An efficiency of 1·1 watts per candle power, he considers too high for lamps used on the ordinary supply circuits, though it might be correct under ideal conditions—say, where the voltage was never more than 1 per cent. above the normal. It is often stated that, on account of the resistance of a tungsten filament increasing with the temperature instead of decreasing, as in the case of carbon filaments, that the former is far less susceptible to change of voltage than the latter, and that the life is not so adversely affected by a rise in voltage. This may all be true when the efficiency is 1·1 watts per candle power or less; but when the lamp is operated at efficiencies over 1·1 watts per candle, there is reason to doubt if the statement still holds good. It is believed by Mr. Findlay that the life of a tungsten lamp burning at 1¼ watts per candle is four times as long as it would be if burned at 1 watt per candle power. The difference in efficiency will be caused by a difference of 10 per cent. in voltage, and will be accompanied by a rise of 40 per cent. in candle power and 5½ per cent. in current. The total cost of light, at 4½d. per unit for current and 4s. for lamps, will be for a 30-candle power lamp, burning for 250 hours at 1 watt per candle, 32·7d. per 100 hours, while a 30-candle power lamp, burned at 1¼ watts per candle for 1000 hours, will cost 21·7d. per 100 hours. So long as lamps remain at their present price, there can be no economy in burning them at anything above 1¼ watts per candle; and it will probably pay to buy lamps even if rated at 1¼ watts per candle, for a voltage 2 or 3 per cent. higher than the declared voltage, so that they may be able to withstand temporary rises in pressure.

There has been a strong endeavour in the Financial Press to give a spurt to interest in London electricity shares, the market values of which have lately had a poor relation to nominal value. Our financial contemporaries, we rather think, are blaming overmuch for this condition of things the electric power schemes that have been dangled without success before Parliament now for some years, and are not giving sufficient consideration to what is perfectly obvious to those who take the trouble to study the

accounts of the undertakings, that, in addition to the reduction of revenue per consumer using metallic filament lamps, the scale of extreme differential prices for various purposes has operated to reduce the average income per unit in greater proportion to the reduction of the average expenditure through working economies. But now it is thought an opportune time—seeing that the Board of Trade and Parliament have settled the future of the existing undertakings—to bolster-up the hopes of peace in the electric supply industry of London, and to stir up the belief that there is a more profitable future now in store for the Companies; the sole object being to put life into the market for the shares. The linking-up scheme, and the application of the Board of Trade plan to centralize the concerns in the London County Council in 1931, are construed as an assurance that the Board of Trade will not look favourably upon any future bulk and power scheme that any group of adventurous persons may bring along, and certain it is that no London County Council, with 1931 in mind, will care now to bring forward a power and bulk scheme of their own. It is extraordinary that nothing has been heard in the way of complaints over the killing of the power projects from those manufacturers who were supposed to be crying aloud for such a scheme for London. However, those who are persuaded to look upon London electric lighting shares as an improved investment, should not overlook the fact that the terms of purchase in 1931 are to be the fair market value of the plant, without any allowance for goodwill, compulsory purchase, or any other consideration. This being so, while the average profit per unit is decreasing, while lamps are coming to the fore that diminish the revenue per consumer, a liberal estimate will have to be made of their requirements, so as to supplement the money received in 1931 from the County Council as representing the mere market value of the Companies' plant. Under these circumstances, it is doubtful whether the shares are worth much more consideration now than they were when power and bulk schemes were threatening.

A large fancy bazaar, filled with toys and light goods, and with hundreds of men, women, and children on buying intent, is not a suitable place for a conflagration and especially one starting with such "appalling suddenness" that it gets good and well-spread hold of the inflammable material before the building can be cleared of its scared throng. Such a fire occurred at Landport, Portsmouth, last Tuesday; and it was only by the courageous efforts of the police that there are not, at this festive season, many darkened homes in Portsmouth. The building was electrically lighted; and to the fusion of an electric wire the catastrophe is attributed. Probably the electrical papers will from their London offices send forth a flat denial, or trot out some of their musty quips over the daily paper reporter. Before writing, perhaps they will remember the words of Mr. S. G. Castle Russell, M.Inst.E.E., Chief Electrical Engineer of the Phœnix Insurance Company, to which attention was called in the "Memoranda" on the 15th inst. He said: "I read in the electrical papers from time to time complaints that the newspaper reporter is very fond of a stock phrase concerning the 'fusing of an electric wire' when writing of a fire. . . . I would state definitely that not half of the electrically caused fires in this country are reported in the daily newspapers."

"What the future has in store none can tell." These philosophic words open an article by "Interested," in the "Electrical Review," treating of the future financial position of municipal electricity supply undertakings. With the general tenor of the article, we are in entire agreement. It would be an excellent thing if municipal councillors would read what "Interested" has to say, and act upon it. But we have our fears. The line of municipal policy when once adopted appears to be as sacred and immutable as the Koran. Still one feels some of the rough edge being taken off the fear, when a person from behind the scenes tell us that, "at the present time, those interested in municipal electricity supply stations are trying to forecast their future financial position." Looking at the position of an undertaking borrowing money for the purposes of constructing and carrying on electricity undertakings, and repeatedly borrowing as capital is required, this exponent of pure and sound finance asks whether it is the intention of municipal councillors ever to free their electricity undertakings from their heavy capital charges. If so, vastly different methods will have to be adopted in their accounts. Larger portions of capital must be redeemed each year; less put to the relief of the rates; and as much as is possible of all future additions and extensions must be paid for out of revenue, so as to make the sinking fund really sink, and not grow as in most cases now. If not, then "Interested" can foresee the Committees finding the annual redemption and interest figures totalling up to more than the profits for the year. The oft-recurring word "deficit" in the reports of municipal electric undertakings suggests to us, if not to the writer of the article under review, that "the annual redemption and interest figures" already often "add up to more than the profits for the year." It is regrettable, but it is the fact; and it is judged from what is written in the article that our friend is looking forward not gladly, but somewhat sorrowfully, to the "deficit" condition being in future a still more frequent one. That is bad; but it only seems to be avoidable by following out his suggestion. Of course, the trouble is that so many of the electricity undertakings do not make profits with which to redeem a larger amount of the capital. Likewise many Committee chairmen have nothing to magnificently hand over to the relief of the rates; and so how to lessen the sum is one of those brain-racking puzzles that some people—municipal councillors among them perhaps—like to indulge in during the Christmas season, but from assisting in the attempt to solve which we must ask to be excused.

In the "Installation Topics" of the "Electrical Times," electric supply authorities are soundly rated on account of their inefficient system of canvassing and outside representation generally; it being avowed that there are companies and municipalities who send out men who are more suited to distribute tracts than to talk sensibly about a supply of electricity. We will not expose further (as is done by our contemporary) what happens when one of the immaculate young men from the electric supply undertaking turns up at a prospective consumer's house or place of business. But when there are so many qualified electricians among the unemployed just now, it is certainly heart-rending to realize that quite a number of representatives cannot describe the essential differences between a motor and a sausage-machine, and can only make a number of unintelligible statements about many things, together with extravagant assertions as to the savings that metallic filament lamps effect, and recommendations for their use on every fitting irrespective of the candle power required. Having preferred his charge of incompetence, the writer of "Installation Topics" makes this kindly recognition of the more advanced notions of gas suppliers as to the qualifications of a gas canvasser: "The gas companies recognize the value of technical knowledge to an outside man; and within an hour or so after an inquiry comes in, a representative waits on the prospective consumer, fully equipped to deal with any question which may arise in discussing the use of gas for light, heat, or power. A client is far more likely to close with an offer made on the spot by one who knows what he is talking about, and whose visit will be followed promptly by the men with the pickaxe and gas-barrel, than to wait for the leisurely estimate from the electric supply people, which, when it arrives, may or may not cover his requirements." And, we would add, is often incomprehensible to him.

After reading this, we turn to the "Electrical Review," to find that there is a resident in South London who (this we gather from the fact that it is fully set out) rejoices in the name of W. Perren Maycock. This gentleman requires the attention of one of the qualified representatives of the gas company. He is a gas consumer against his will, because the electric cables have not been brought up to his door. He is likewise a very stubborn person, and threatens that he will not spend a penny on improving his gas-fittings, though he has a choice selection, ancient and modern, of flat-flame and upright and inverted burners. Every living thing in the house he asserts is being poisoned; but, when saying this, he has forgotten an earlier reference to his "robust baby and robustier dog." "I am subjected," he pathetically writes, "to a series of explosions—of wrath—from an infuriated person of the female persuasion, who vows that her health and temper are being ruined, that the very plants are being killed (and so they are!), that the table flowers last about two days instead of the two weeks they would do under electric conditions, that the silver would disgrace a pigstye, that the very dog is unhappy, and—various other things. We live in dread of being blown to Heligoland when the ancient and corroded chandelier gives out (I positively refuse to get a new fitting); and altogether my feeling is that electricity at any cost for wiring and any price per unit is better than gas at a gift." Is it a gas or another sort of specialist that the writer of such trash requires? Anyway, a man who lives in dread of losing his life and deliberately exposes the lives of his wife, robust baby, and still "robustier" dog to such danger, requires protecting against himself.

We wonder whether the managers of electric lighting undertakings will detect a line of sarcasm that appears in a note by "Meteor" of the "Electrical Times" on a leaflet received by him from Mr. Oswald Hanson, of Fleetwood, from which it would appear that "the cost of lighting the parish church by electricity during the last twelve months was £12 10s. The gas bills for the previous two years amounted to £26 8s. 5d. and £22 1s. 7d. respectively. The saving at St. Margaret's was even more remarkable, the lighting only costing £3 for the whole year." "Meteor's" comment is that "apparently the type of gas lighting to be found in a church is particularly easy to score against." From which it would seem that our journalistic friend is not particularly enamoured of the central station engineer's method of taking an ancient piece of gas lighting and comparing it with a modern installation of electricity. It is true the type of gas lighting to be found in a church is particularly easy to score against; for, as a rule, the burners are the old flat-flame gas wasters. "Meteor" also thoughtfully reminds how easy it was in Westminster Abbey for inverted incandescent gas-lights to score, in respect of cost, against the type of gas lighting formerly doing duty there.

At a recent exhibition of scientific apparatus by the Physical Society, conspicuous features were the gas burners and furnaces designed by M. Méker, of Paris, shown by the Cambridge Scientific Instrument Company, Limited. One of these burners was illustrated, and the results of tests were given, in the "JOURNAL" for the 14th of July last (p. 100), in connection with a paper read by M. Méker at the last meeting of the Société Technique. At the same exhibition, Messrs. Alexander Wright and Co. had on view an ordinary bar and a portable photometer.

AMERICAN PRACTICE IN GAS CALORIMETRY.

THE report of the Sub-Committee on Calorimetry presented at the last meeting of the American Gas Institute forms an interesting document, of which the substance is reproduced on another page of to-day's "JOURNAL." Perhaps the most striking portion of it is the conclusion that the calorimetric method of testing the value of a given gas is decidedly preferable to the photometric method. It is suggested that the question involved in this conclusion should be further studied with a view to a definite recommendation being made to the Institute at next year's meeting. There can be no two opinions as to the correctness of the conclusion; and the only wonder is that English and American gas undertakings have not already taken steps to suppress the comparatively useless periodical testings of illuminating power which are commonly made as a control on the quality of their gas.

Gas calorimetry as at present practised may be said to have been founded by Mr. F. W. Hartley, and (after a lapse of many years) developed by Professor Junkers, who has been followed by a few others, among whom is Mr. C. V. Boys. It is to be regretted that the American Committee made no mention of Mr. Hartley's pioneer work, especially as most of their recommendations as to the design and operating of a gas-calorimeter might have been drawn from his writings. The Committee, however, have indirectly honoured Mr. Hartley by recommending the adoption of a calorimeter based generally on his ideas, even to the weighing of the water collected during a testing in preference to measuring it only. In recommending also the use of thermometers graduated on the Fahrenheit scale, in stating the amount of collected water in terms of the English instead of the metric system of weights, and in computing the results directly as "British thermal units" per cubic foot, the Committee have followed Mr. Hartley's views. And generally we agree with them and him as to the absurdity of using other scales and units wherever gas is sold by the cubic foot and solid fuel on a system of weights based on the pound avoirdupois. No one in England or America quotes the calorific power of coal or coke in terms of calories per pound; and it is time that the equally hybrid and futile nomenclature of calories per cubic foot for the results of testings of gas should be abolished. When gas is sold by the cubic metre and coal by the 1000 kilos. or metric tonne, it may be found useful also to give their heating values in calories instead of British thermal units.

As to the use of thermometers graduated on the Fahrenheit instead of the Centigrade scale, probably the chief reason why they have not hitherto been adopted by English calorimetrists is that they are more costly, owing to Centigrade thermometers of the grade required being produced cheaply on the Continent, whereas the necessary Fahrenheit thermometers would ordinarily be obtained from makers here who are unable to manufacture at so low a cost. But if a serious demand for Fahrenheit thermometers of suitable grade arises, they should soon be obtainable as cheaply as the others.

We are not greatly enamoured of the American Committee's proposal to weigh the water collected during a testing, instead of following the now usual practice of measuring it, which Mr. Hartley accepted as an alternative method. The weighing is inconvenient and tedious; and provided a measuring vessel is used having the graduated portion of the stem contracted, it affords no appreciable gain in accuracy.

Of the particular instruments tested by the Committee, the Junkers and the latest type of the Sargent (an American make) calorimeters find most favour with them. The Boys calorimeter, being designed for the testing of gas of very limited range of variation in calorific power, was not found suitable for general use in America, where gas supplies differ much more widely in composition and calorific power than over here. The intelligent adaptation of this calorimeter to general (as distinguished from specialized) statutory gas testing, is greatly needed; and we hope it may be undertaken. It possesses so many inherent advantages—several of which appear to have been overlooked by the Committee—that it is a pity its scope should be restricted by its present hard-and-fast proportions and construction—probably adopted with the intention of eliminating even the personal vagaries of gas examiners whose highest attributes should be those of an automaton. But there is no reason why, for other uses, it should not be intelligently modified.

Passing on to other matters, the American Committee prefer to measure the gas supplied to the calorimeter by a meter recording one-tenth of a cubic foot per revolution, instead of one-twelfth of a cubic foot which is common here both for calorimetry and photometry. There appears to be no appreciable gain, and some loss of convenience, by the change. We are also sorry to see that the decidedly ineffective German pattern of pressure regulator is preferred by the Committee to the delicate and simple English type of balance governor. This curious preference and certain observations on details of other English apparatus lead us to wonder whether the Committee had before them proper examples of the latter. On this account, we are glad to note that the report contains suggestions for further investigations on the subject, and for the passing on of the whole question for further study by next year's Technical Committee of the Institute. The present report should, we think, be regarded rather in the light of a statement of the results of preliminary eliminating trials than as the last word of the American Institute on the subject of gas calorimetry.

A BUDGET OF LABOUR STATISTICS.

ALL sorts and conditions of labour are referred to in the Twelfth Abstract of Labour Statistics of the United Kingdom, which deals with 1906-7, and has lately been issued by the Labour Department of the Board of Trade. A considerable amount of the information here given has already been published in sectional volumes prepared by the Department, and duly noticed in our columns; but there are some interesting particulars not so far mentioned, which may be the subject of brief attention now.

In the first place, there are the standard rates of wages and hours of labour recognized at different towns on Oct. 1 last. Particulars relating to the building trade, which are given very fully need not be troubled about; and we will pass on to the engineering and shipbuilding branch, which is divided up into the six sections of pattern makers, ironfounders, engineers, boiler makers and iron shipbuilders, brass moulders and finishers, and shipwrights. As to engineers, in the London district the rate of pay per week for turners, fitters, and smiths is given at 40s., of pattern-makers 44s., of ironfounders 41s. to 43s. In the marine shops at Cardiff, turners, fitters, and smiths get 41s. per week; but in Ipswich the wages for a 50 and 54 hour week are put down at 28s. In the majority of cases the figures appear to be between 36s. and 38s.; and it is stated that the rates given are those recognized as minimum rates for a full week's work, exclusive of overtime, by the principal Trade Unions according to the latest information in the possession of the Department, while in many cases the rates have been agreed upon between the Employers' Associations and the Trade Unions.

With regard to profit-sharing schemes, there were 51 known to be in operation in the United Kingdom at June 30, 1907. Of these, 1 was in the building trades, 1 in mining and quarrying, 2 in the metal trades, 5 in engineering and shipbuilding, 4 in the textile trades, 3 in the clothing trades, 1 in agriculture, 6 in the printing and allied trades, 1 in the wood working and furnishing trades, 2 in the chemical, glass, pottery, and similar trades, 6 in food and tobacco, 5 in gas-works and tar-distilling, and 14 in other businesses. The number of persons working under these schemes on the date named was 44,815, as compared with 47,488 twelve months before. Since 1829—in which year the first of the recorded schemes was started—no less than 127 schemes have ceased to exist; and the reasons given for their cessation may be noted. They are as follows: Death of employer, 2; job finished, 2; enterprise abandoned, 4; liquidation or dissolution, 18; changes in, or transfers of, business, 15; losses or want of success, 21; diminution of profits, 5; apathy of employees, 10; dissatisfaction of employees and grant of increased wages, 2; disputes with employees, 3; dissatisfaction of employers with results, 31; grant of shorter hours, 2; substitution of fixed rate of interest, 1; special circumstances, 5; and cause not known, 6. The ratio of the bonus allotted to wages, of course, varies enormously; but taking 38 cases in 1906, the average bonus was 8 per cent. on the wages of the participants.

Among the accidents reported under the Factory and Workshop Acts in 1907, there appear under "Gas" the following statistics: Fatal accidents caused by machinery moved by mechanical power, 2; non-fatal, 173. Hot liquid, molten metal, &c., in vat or pan, fatal, none; non-fatal, 66. Explosion, fatal, 2; non-fatal, 61. Escape of gas, steam, or metal, fatal, 4; non-fatal, 70. Other causes, fatal, 7; non-fatal, none. This made a total of 15 fatal and 370 non-fatal accidents.

At the end of 1906 there were 1161 Trade Unions, with a total membership of 2,106,283, as compared with 1298 in 1897 with a membership roll of 1,648,904. The 100 principal Unions in 1906 had a membership of 1,273,995, and an income of £2,344,157, or 36s. 9d. per member. The expenditure was £1,958,676, or 30s. 9d. per member; and the total funds at the end of the year amounted to £5,198,536, or 81s. 7d. per member. The National Union of Gas Workers and General Labourers of Great Britain and Ireland had a membership of 40,042 in 1897; and the figure rose to 48,030 in 1899. Since that time, however, things have not been so flourishing with the Union; and the number of members suffered a heavy decline down to 1905, when it reached the low level of 28,120. The next year—1906—was a little better again, as the figure is given as 33,680. The income of the Union has not shown a corresponding line on the chart; for whereas in 1897 it was only £16,369, in 1907, with many less members, it totalled £18,524. The expenditure in the latter year was £20,737, or about £2000 more than the receipts; and at the end of that year the funds in hand only totalled £4457.

In 1906, there were 2157 workmen's co-operative societies which made returns; the membership being 2,334,641, or 5·3 per cent. of the population of the United Kingdom. The share capital was £30,117,193, and the loan capital was £9,781,027; while the amount of sales is given as £98,403,692. At the census of 1901, in England and Wales, out of 14,328,727 persons "occupied," 68,510 were engaged in gas, water, and sanitary service; in Scotland, 8461, out of 1,982,812; and in Ireland, 1715, out of 1,949,607. Thus the total for the United Kingdom was 78,686, out of an occupied population of 18,261,146. The number of persons of all ages without specified occupations, or unoccupied, was 23,197,575—making a total population of 41,458,721. In 1904, the number of persons employed in gas-works is given as 62,784; and in electricity generation, &c., as 13,881.

The number of workmen's compensation schemes in operation

at June 30, 1906, was 50; the workmen employed being 106,247, and those contracting out of the Acts under the schemes 102,551. The contributions by workmen amounted to £36,286, and those of the employers to £52,374. The payments to members and expenses totalled £91,499, and the funds at the end of the year were £187,970. Among 27 schemes in 1906, the estimated maximum amount payable under the Workmen's Compensation Acts for incapacity was £7352, while the amount actually paid under this head was £11,511.

THE IRON AND STEEL TRADES IN 1908.

THE year that has now so nearly drawn to a close has not been one which will be dwelt upon with any great amount of pleasure by those who are engaged in a good many important industries that have experienced a slackness of demand in their particular lines. Even to the onlooker the acuteness of the unemployed problem and the series of melancholy trade returns have brought home the fact that business generally during 1908 has been of an unsatisfactory character. In such circumstances, one would usually prefer to speculate upon the future than to ruminate upon the past; but in the present instance is this likely to be the case? Signs of improvement have recently been noted by some eager watchers; but the situation still appears to be fraught with uncertainty. At any rate, with regard to the iron and steel trades, Messrs. Bolling and Lowe (with a copy of whose annual trade review we have once more been favoured) remark that they would like to share the hopeful views that occasionally reach them as to the business prospects of 1909; but they fail to trace any substantial grounds for anticipation of appreciable improvement in the near future.

The iron and steel trades are, of course, among those that have suffered pretty severely from depression during the past twelve months. But prices and demand have not invariably taken the same direction—pig iron having proved an exception to the general rule in this respect. The present year, the review tells us, opened with a quotation for pig iron of about 49s. per ton, and closes at a similar figure; and this apparently inconsistent firmness of price (in spite of increasing depression) has not, as is often the case, been caused by speculation. The explanation is that prices have been supported in spite of decreased exports by the continued firmness in raw materials and labour—fuel and ore particularly having maintained values quite unwarranted by the figures obtainable for pig iron. Thus while prices of almost all other articles were declining, pig iron slightly advanced; and a return to the figures ruling at the close of 1907 only commenced towards late autumn.

The tale to be told with regard to steel rails is a much less satisfactory one from the seller's point of view; for whereas at the end of last year the English Rail Syndicate price in England for heavy rails ruled about £6 to £6 5s. per ton, at the present time, for orders of any magnitude and approved specification, as low as about £5 5s. is being accepted. Apparently, too, the worst in this direction has not yet been seen; for Messrs. Bolling and Lowe hazard the opinion that before long prices will be still lower. At the same time, however, they admit that the prices quoted by the Sydicate depend upon so many factors that it is difficult to know just what they are prepared to accept. The question of the allotment of orders among the members of the International Syndicate is one of these influences. Then a new source of competition has arisen in the Canadian steel mills, which have taken orders for India and Australia; while the American mills have been booking business for our own Colonies. In fact, say the reviewers, the whole position of the rail trade is inexplicable. Prices of steel joists have fallen from £5 9s. a ton to £4 14s. for good quantities. As a strong indication of the condition of business, it is pointed out that English joists, hitherto out of the running, can now be had at prices that are equal to, in many cases lower than, Continental rates. With regard to the international tube agreement, which was brought about in December last, all one can say is that the length of its existence did not justify the trouble taken over it—for the Syndicate was dissolved in July. As to finished products generally, the decline in prices that began in the autumn of 1907 has continued up to the present time, with the result that in many markets there has been a reduction of 20s. to 30s. per ton.

The hopeful expectations at the beginning of 1908 with regard to copper—arising from the severe steps taken in North America to cut down production—were not destined to complete fulfilment; for the extreme movement in prices of standard copper has been from about £56 to £65 per ton for cash delivery. Since the summer, a complete change has taken place regarding supplies in North America; mines having been opened there in all directions, and smelting operations having been pushed forward with the utmost vigour. Thus, instead of a smaller output than in 1907, it is now considered practically certain that 1908 will exhibit a large increase. The future of this market, Messrs. Bolling and Lowe say, depends entirely upon the management of the large and still accumulating stocks. There has been a huge increase in the supplies of tin brought into sight from the Eastern producing districts; and perhaps this may to some extent be explained by the fact that the price rose from £118 10s. per ton for cash delivery in January to £147 towards the spring. This, however, proved the highest price of the year; and during the summer months heavy shipments brought this figure down to £124 per ton.

Referring to trade in other countries during 1908, the review says that for ten months the pig iron production of Germany and Luxembourg is nearly 1,000,000 tons less than in 1907; while the deliveries of the German Union tell also a sad tale of decrease, the figures at the end of October showing above 700,000 tons less than in the corresponding period of last year. "Nothing," it is remarked, "can be more significant of the world-wide depression of trade than is shown by the falling-off in a country whose powers of competition, aided by the highest forms of technical ability, are unable to withstand the tide of adversity. The best developed form of organization notwithstanding, the cry of the unemployed appears to be as loud as elsewhere, and is in itself an index of the absence of business." Belgium has also suffered severely; and current prices testify to the extremities to which makers have been driven. As to the United States, the opinion is expressed that the Steel Trust have not escaped their full share of bad trade.

Messrs. Bolling and Lowe conclude by giving our exports and their value of pig iron and iron and steel for the eleven months ending Nov. 30 of each of the past three years. They are as follows: Pig iron: Year 1906—1,498,002 tons, value £5,184,986; 1907—1,853,635 tons, value £6,881,870; 1908—1,209,452 tons, value £3,809,616. Iron and steel: Year 1906—2,940,791 tons, value £31,732,999; 1907—3,138,578 tons, value £37,067,362; 1908—2,694,609 tons, value £31,008,812. The total exports were: Year 1906—4,438,793 tons, value £36,917,985; 1907—4,992,213 tons, value £43,949,232; 1908—3,904,061 tons, value £34,818,428.

THE DESTRUCTION OF DAYLIGHT.*

THE subject of this book is one that is closely allied to the work of gas supply undertakings. It is in the prevention of smoke that the use of gas is so beneficial and so much to be commended. If only the misguided municipal authorities owning gas-works were to give the gas-consuming ratepayers this ideal smokeless fuel at cost price, instead of following the defenceless policy of appropriating large sums of money in the form of profits to be distributed alike between electricity and gas consumers and others who are consumers of neither, much would then be done to purify and brighten the atmosphere of many northern towns. Again, if gas companies were to have freedom to supply the quality of gas required by their consumers, how much money would be saved by the gas-consuming public? How much less coal would be burnt to defile the air we breathe? The sliding-scale, in the admirable protection it gives to the consumer, should be sufficient in itself to ensure fair treatment to the public.

The author is an enthusiast in the problem of smoke abatement. He shows this in his vigorous condemnation of the slack, do-nothing methods of so many local authorities. He hints at the causes of it, and suggests remedies, some of which might be considered rather revolutionary, though they would doubtless have the desired effect. He puts forth with some eloquence the injurious results of smoke, and the effect of its presence on the inhabitants of our towns. A lucid explanation of the consequences of smoke shows plainly that one of the worst features of its production is the cumulative nature of the evils it brings in its train. Thus sunlight, with its valuable disinfecting properties, is effectually excluded, resulting in illness and the spreading of disease germs; also curtailment in the production of oxygen by plant life, which only under sunlight gives off the oxygen so necessary to our health and well being. The author emphasizes the ill-effects of smoke by a dissertation on the beauties of Nature, showing how Ruskin, a true lover of Nature, dreaded the effects of smoke. In 1871, he speaks of it thus: "It is a new thing to me and a very dreadful one. I am fifty years old, and more, and since I was five, have gleaned the best hours of my life in the sun of spring and summer mornings, and I never saw such as these till now. It looks partly as if it were made of poisonous smoke; very possibly it may be. There are at least two hundred furnace chimneys in a square of two miles on every side of me." It would seem as though the worst effects of smoke are of later origin; for the consumption of coal is now double what it was in 1873.

The author reproduces from "London Fog and Smoke," by the Hon. Rollo Russell, an estimate of the actual annual cost of smoke and fog to London. Based on the population in 1888, it is calculated that the waste of fuel in emitting smoke, and resulting damage from its production, amounts to no less than £5,470,000—a figure which represents about £1 per head. On the same basis, the estimate at the present day would be far in excess of that given.

A chapter on "Combustion" tells us several interesting facts, all of which emphasize the benefits of gaseous fuel. He explains that when coal is burnt the sulphur contents, amounting to nearly 2 per cent., are emitted as sulphurous acid, which, if scattered freely into the air, would do much less harm than it actually does were it not mixed with the soot and tarry oils of the smoke. Is it not an anomaly that the burning of coal with the resulting effects of a large yield of sulphur is freely permitted, while the

* "The Destruction of Daylight: A Study in the Smoke Problem." By John W. Graham, M.A. London: George Allen, Charing Cross Road. 2s. 6d. net.

burning of gas with its almost negligible production of sulphur is under stringent restrictions? It would appear to be an excellent example of the pot—and a very be-sooted pot—calling the kettle black. Dr. Cohen, as the author points out, found by experiment that 15 per cent. of the soot from the combustion of coal is a dark-coloured sticky oil, much of which cannot even be removed by rain.

In dealing with the domestic grate, the author gives particulars of several of the best types for the proper combustion of coal; but he suggests efficient substitutes, which are entirely smokeless, as the only means of rendering our domestic chimneys free from offence. He mentions Sir Charles Cookson's plan of using coke in ordinary grates each of which is provided with a gas-burner for lighting. The author goes further, and suggests a combination of coke with gas always burning. He is a firm believer in the further cheapening of gas as the easiest way to cure smoke. He points out that in Plymouth, where gas is sold at 1s. 9d. per 1000 cubic feet, gas fires and cookers are common, and the air is remarkably clear. In the neighbouring town of Devonport, however, gas costs 2s. 6d., and is used less, with the result that there is the usual smoke nuisance. He further expresses the opinion that the use of coal in houses might be wholly abolished by gas at 1s. 6d. or 1s. 9d. per 1000 cubic feet, where gas at 2s. 3d. is a little dearer than coal. The author suggests that the same price should be charged for gas for all forms of heating as is now charged for power. [This is in accordance with the policy advocated in the "JOURNAL" twelve months ago.]

Extracts from the report on gas-fires by the Coal Smoke Abatement Society, carried out in 1906, are reproduced. In this series of tests, the comparative results are based on gas at 3s. per 1000 cubic feet, which is too high a price to take as an average; and yet the Society report that, "taking into consideration the amount of coal which must be burnt before a comfortable and steady warmth is produced, and also the amount which must be burnt after the fire is no longer required, the examiners think that, even from the point of view of economy, gas would run coal very closely for domestic purposes, where it is seldom necessary to have a fire constantly burning for long periods." Coalite comes in for some appreciative remarks—certain of them without doubt prompted by the extravagant claims put forward by the promoters in their remarkable advertisements. We are, for instance, told that it "promises to cure at any rate the domestic smoke evil at a blow," and that "the heat is not blown up the chimney, but radiates into the room usefully." Again "it may revolutionize English life." After the final sentence, a hope is expressed that it may be produced cheaply. Yes, it is the *£ s. d.* which is the *crux* of the whole matter. A couple of chapters are devoted to the "Hand-Firing of Boilers and Mechanical Stokers," showing plainly that smokeless chimneys are possible, if only the authorities will enforce the law. This would mean in some cases an increase in boiler power, and would also encourage the installation of mechanical stokers, the principles of which ensure for the most part smokeless firing.

In a chapter on "Gas and Electricity," some extracts are reproduced from the report of the Royal Commission on Coal Supplies. It is here shown that the replacement of steam-engines by gas-engines would show "enormous economy," and would have an important effect on our coal consumption. Whereas a high-class steam-engine will use 2 lbs. of coal per horse-power hour, a gas-engine will only use ¾ lb. of anthracite (or 1 lb. of coke) to produce the same power. Much is said in favour of gas; and in connection with the smoke problem the author describes it as one of the most important and hopeful cures both for power and domestic use. He shows how far preferable it is for coal to be converted into gas, coke, tar, and sulphate of ammonia than to be used in its raw state. The author states that the terrible atmosphere of the Potteries is likely to be cured by the use of gas-ovens, which have proved a success; he further mentions the fact that at Glenboig for twenty years bricks have been successfully fired by gas. The use of gas is admirably summed up in the sentence: "It means organized science applied to industry for the benefit of civilization—it stands for economy, instead of smoke, coal dust, and barbaric waste." This is well said.

The author discusses the law in relation to smoke, pointing out the loopholes which allow manufacturers, generating stations, and others, to escape penalties. It is plain that the law requires readjusting in the first place, and then enforcing with similar supervision as exists under the Alkali Acts. Several excellent suggestions are contained in this chapter, based to a certain extent on the stringent rules enforced in Nottingham, where the need for keeping the lace clean compels the manufacturers to prevent smoke. In dealing with the question of our national coal supply, it is clearly shown that the very cause which is polluting our atmosphere bids fair to exhaust our coal resources far sooner than would be the case were smokeless chimneys enforced. Two birds would then be killed with one stone.

The little book is well-arranged and clearly written; while the arguments in favour of smokelessness are very convincing, and to the point. The author has managed to put a mass of information into a small space, and no important matter seems to have been omitted. It is well worth reading.

Mr. C. A. Whitmore, whose death was announced in the "JOURNAL" for the 15th of September, left estate valued at £8128 gross, with net personalty amounting to £1957.

DIFFERENTIAL PRICES FOR GAS.

[COMMUNICATED.]

THE question of a rebate for gas used for cooking and heating has been discussed on numerous occasions; and it is generally agreed, in most quarters, that some reduction should be made in the charge for gas when used for this purpose. Gas is admittedly cheap for lighting purposes; it seems almost too cheap when it is realized that one can get the use of a 60-candle power light for ten or twelve hours for the small sum of 1d. But for heating, whether it is food, or water, or air, the cost is considerable, though found to compare on fairly equal terms with coal. In competition of this sort, there is, however, a large amount of prejudice to be overcome. People are accustomed to coal, and will not readily give up using it. Experience has taught them the cost of its use; while the cost of gas as an alternative is to many an unknown factor. Cooking-stoves have undoubtedly become very popular, and may be relied upon to push themselves with infinitely less trouble than that required to push the use of gas-fires and water-heaters. There should be a large field open for gas undertakings in domestic houses if every facility is given for people to adopt the use of gas-fires for heating rooms and hot-water circulators or geysers for heating water.

Several suggestions have been made as to the best means of extending the sale of gas for this purpose; and the system which has met with the most favour has been one in which a discount is allowed for gas used for power, cooking, and heating. This system entails the fixing of several small meters, perhaps six or more in a house, unless the alternative plan of a separate supply pipe for heating gas is considered preferable. The latter course would usually be quite impossible, except in new houses; while the first plan would mean a considerable outlay on meters, the rent of which would be a tax, and a considerable one, on the householder. He would indeed, after having fitted up his house with gas-heating appliances, and after having paid his meter-rents, require to use a large amount of gas to have made it worth his while to have gone to the expense. Yet another system is that by which a discount is allowed to all whose consumption exceeds a fixed limit, indiscriminately whether it be used for lighting or heating. A scale of discounts is usually arranged in these cases; so that a large consumer using (say) a million cubic feet per annum will get a rebate amounting to as much as 1s. per 1000 cubic feet. This system would undoubtedly increase the sales of gas very largely. But it is wrong in principle; for it would quite unnecessarily encourage the very large field of lighting business as well as the heating field, which is the particular sort of consumption so much desired by gas undertakings.

The question is, How can the heating requirements of a consumer be best met? Surely by fitting up his house with heating appliances at no expense to himself, trusting to the extra consumption to pay the cost of fixing, and the interest and depreciation of the appliances. This would undoubtedly mean a heavy outlay, and for this reason would not be considered by many gas companies, irrespective of the great increase in consumption it would certainly secure. As to the soundness of the system from a financial point of view, the writer will give a particular instance in which a house was first fitted for lighting only, and was afterwards fitted with a cooking-stove, a geyser, and three gas-fires—all of them being purchased by the consumer. The increase in consumption in this particular case will be taken as the basis upon which to show that the installation would be profitable to the gas company had it been their property and fitted up at their expense.

First, as to the cost of the installation. The following list gives it in detail:—

	£	s.	d.
One Welsbach-Kern radiator, green enamelled	1	18	8
One Welsbach-Kern radiator, " "	1	2	0
One Welsbach-Kern radiator, black		13	0
Fitting alone		15	0
One Ewart's "Royal" geyser	2	18	0
Flue		10	0
Fitting		10	0
One cooking-stove	3	0	0
Fitting		7	0
	11	13	8

The cost could have been reduced by about 15s. in this case had all the radiators been of the plainest type; but as the geyser was not provided with any of the extra fittings—such as the swing-out burner, and the automatic self-closing gas-valve—the cost may be left at the actual amount expended. The cost has been taken at the usual prices charged to gas companies; but it is more than probable that, where large numbers were required, more favourable prices could be obtained.

As to the consumption of gas in this particular house, it was found that, taking the price at 2s. 3d. per 1000 cubic feet, the annual bill amounted to £4 16s., on an average for a period of three years, for lighting alone. Although the house has now been fitted with the above-mentioned appliances for a period of only eight months, yet it is still possible to give a very approximate figure as to the extra consumption for heating resulting from these additional fittings. During the two summer quarters, it was found that, whereas for the three previous years it amounted to 34s. on an average for the six months, this was increased to 83s. during the six summer months of the current year, after the heating

appliances had been fixed. The winter consumption during the past three years has amounted to 62s. on an average for the six months; but now, with the extensive use of gas for heating, the consumption is at the rate of 175s. for the six winter months. Taking these figures as the basis upon which to work, it will be seen that an expenditure of £11 13s. 8d. has resulted in an extra consumption of £8 2s. worth of gas. Had the company fitted this house at their own expense, let us consider the return which would have resulted from the outlay. If 20 per cent. annually, of which 5 per cent. is for interest and the remaining 15 per cent. for depreciation, be deducted from the capital outlay, a clear profit of 46s. 9d. must be netted to render the capital expenditure profitable. Anything extra will help to swell dividends. The question to consider is whether the consumption for heating alone would be sufficient to bring in this amount of profit.

Taking the same case as a typical example. From the above figures it will be noticed that the bill has been increased by no less than £8 2s. per annum—an amount which represents a consumption of 72,000 cubic feet of gas. This particular consumer is supplied by a company whose profit amounts to 8d. per 1000 cubic feet of gas sold. Deducting this amount from 2s. 3d., the cost of manufacture and distribution is 1s. 7d. It would, however, be wrong to assume that the gas resulting from a largely increased consumption would cost this amount, or anything like it. The standing charges and several other items would still amount to the same figure were the consumption increased by 10 or 20 per cent., or more. Deducting the standing charges and reducing the other items affected, the result may be stated as follows:—

	d.	d.
Present cost price (excluding profit)	19·00	
Deductions:		
Miscellaneous charges		1·35
Management—		
Directors and auditors		0·10
Salaries		0·13
Stationery, printing, and general charges		0·41
Half cost of collection		0·25
Three-quarters maintenance of pipes . . .		0·90
Three-quarters rates and taxes		1·20
Half salaries, carbonizing wages, maintenance of works, included under the heading of manufacturing charges"		3·28
	7·62	
Actual cost of manufacture	11·38	

All experienced readers are aware of the fact that increased quantities of gas are manufactured at a very much reduced rate. It is for this reason that it is sound business to offer liberal discounts for gas consumption of an advantageous kind. Taking the cost of manufacturing this additional quantity of gas at the round figure of 1s. per 1000 cubic feet, we find that the consumer above mentioned, using 72,000 cubic feet for heating alone, will contribute a profit of 1s. 3d. per 1000 cubic feet for the additional gas. This will then amount to £4 10s. upon a capital outlay of £11 13s. 8d. It was shown above that a profit of £2 6s. 9d. was sufficient to render the outlay profitable. There is, therefore, an additional gain of £2 3s. 3d. On this basis, a capital outlay of £1000 should result in a gross profit of £387, or a net profit of £181, which is equivalent to 18 per cent. after paying 20 per cent. for interest and depreciation. It will be admitted, therefore, that there is a very substantial margin to allow for incorrect assumptions from the experience of a single case. It is unnecessary to dwell on the advantages of a large consumption for gas heating. One of the best features is the assistance it gives in the direction of a curtailment of capital expenditure. The consumption is more equally spread over both day and night; and for this reason a large demand can be met without the necessity of incurring heavy capital outlay on holders, mains, and service-pipes.

Many undertakings have additional plant which can be brought into action if necessary; others have room for extensions. It is these which would benefit most largely from additional consumption; and were a system of this kind introduced on a small scale as an experiment, it would soon be seen whether the scheme would be profitable. The fitting up of a hundred houses in different parts of their district would not commit a gas company to more than a moderate expenditure, and should prove an excellent investment, as well as an interesting experiment. Were a scheme of this kind introduced, provision would be made in the agreement that the fittings may be removed (due notice being given), at the company's option, should the installation prove unprofitable. There is so great a demand for heat in every house, which is now met by the crude method of burning solid fuel, that it is quite time a determined attitude should be taken to grapple with this competition. An advantage in this system is that the expenditure is confined to heating appliances—no portion of it being devoted to the provision of small meters, which is an integral part in any system of rebates. In the latter method, the consumer is charged (say) £1 or 30s. in having his house fitted with gas-fires, and agrees to pay a further rental of a substantial amount (say, £1 yearly) for rental of gas-fires, and probably about one-half this sum for the rent of supplementary meters. The consumer is then allowed a rebate of (say) 9d. per 1000 cubic feet.

Supposing that he used each gas-fire for one hour a day, on an average throughout the six winter months, the cost, at 1s. 6d. per 1000 cubic feet, would amount to £2 1s., and the amount saved owing to the rebate would be 13s. 6d., all, or nearly all, of which would be swallowed up by the rent of the extra meters. He would, therefore, require to use a considerably larger quantity of gas to make it worth his while to have separate meters fixed, and receive a rebate. To revert again to the consumer whose arrangements have already been under consideration, it should be mentioned that the heating of the kitchen, which is a difficulty in the winter where a cooking-stove is used, was overcome by fixing a small gas-fire to heat the room. This fire, which is of the Welsbach-Kern radiator type, is flueless, and stands on the kitchen range; but, being fitted with a flexible tube, it can be stood in the grate if desired. The other two fires of the same type are fitted with flues, which, in the writer's opinion, should be considered necessary in all cases, though with small fires the consumption does not at any time amount to more than 15 cubic feet of gas per hour.

In a small house, where a geyser and cooker are fitted, the hot-water service may be dispensed with—an arrangement which is found to be far more satisfactory, from reasons of economy, than the continual use of a kitchen range. When a hot bath is required, it may be had at any moment with absolute certainty, which is not the case with the best of hot-water services. It is also, generally speaking, a more economical method of heating water. By actual experiment, it has been found that a good-sized bath can be had for an expenditure of ¾d. for gas, at 2s. 3d. per 1000 cubic feet. An estimate of the consumption of gas used in cooking-stove, geyser, and fires shows that, of the £8 2s. spent in additional gas, £4 1s. is due to the cooker, £2 11s. to the geyser, and £1 10s. to the fires. The fires do not show a large consumption owing to the fact that they are rarely used for any length of time. In most houses, the gas-fires would be utilized to a greater extent, especially if one was installed in the sitting room used in the evening by the family, which is not the case in this particular instance.

Enough has surely been said to indicate that a large field of consumption is open to gas companies for heating purposes in all houses; and it would seem, from the figures stated above, that capital spent in installing fittings would be extremely profitable. The rent now received for cookers and fires let on hire would, of course, be forfeited; and the saving to the consumer resulting therefrom would take the place of a rebate. That there should be a reduction made for gas used for heating is conceded by most members of the gas industry; but the method to be adopted to carry out this purpose has not met with any general approval. Where the consumption can be increased in a small house with a rental of £40 per annum, and accommodating four adults and two young children, from 43,000 cubic feet per annum to 115,000 cubic feet, it clearly emphasizes the importance of catering for the heating requirements of houses.

ADVERTISING RUN RIOT.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

It will be obvious that the following remarks do not apply to "Journal" advertisement columns, or to the various leaflets, &c., that have been issued from time to time. It will be equally obvious that they are not aimed at any special advertisement, and that it would be invidious to make pointed references or to select special examples in any of the lines alluded to; and in noting some objections, I do not wish to convey the inference that the whole question can be dismissed as unnecessary or superfluous. In fact, it is rather a sense of its importance that suggests its careful consideration from more than one point of view.

That business without advertising is like the play of Hamlet minus the leading character, appears to be a firmly established axiom in all commercial circles. Advertising is regarded as an indispensable feature in any scheme for making money. No wonder then that it should be looked on as an important item in the commercial department of a gas engineer's duties; and now that it is being seriously considered at Association meetings and otherwise, there are one or two points that should not be overlooked. Unfortunately, there are no means of directly assessing the benefits derived from any one particular venture in this line. Whatever the method may be, there is a large element of "casting bread upon the waters" concerned in it; and this fact alone seems to call for a larger degree of caution when undertaking an advertising campaign than might be necessary if an accurate ledger account of expenditure and income could be kept.

The average man in the street, to whom the advertisement is intended to appeal, does not regard it with a friendly eye. There are advertisements of a special character appealing to one class of the community only, such as those that may be addressed to medical men or architects; but the particular class now in view is that which is distributed broadcast to any and everybody. At a recent discussion, a speaker gave his experience with regard to sending out advertisement sheets with the quarterly bills. The whole enclosure often went straight into the waste basket, and the bills had to be rendered a second time. Such an incident, if not satisfactory, is helpful as showing where the bulk of the advertising matter issued in that particular district goes to, and that the people will not trouble to read it. At the best, only a very moderate proportion of the matter issued can be expected to lead to any result; and a large part is absolutely wasted. I have heard of an old gentleman who read his "Times" every day from first to last, advertisements included; but not one reader in ten even glances at the advertisement columns, even if they are seductively intermixed with the news. The first thing one does

on buying a magazine of fiction or light literature is to shake out the insets. What is our experience? Who reads all the advertising matter received by post or otherwise, and does not pass a lot of it straight to the waste-paper basket? He has not the time, even if he has the inclination, to read it.

There is such a thing as over canvassing and over advertising. We all know the story of how a man was affected by the successive presentments of an advertisement up to about the fourteenth time, when he rushed off and bought the article. In practice, such a satisfactory result (to the seller) does not always ensue. To take an agricultural simile, overdoing the thing may be likened to a liberal use of nitrate of soda on cultivated land. There is an immediate result; but much of it proves to be merely transitory, and the ground is left poorer than before. So customers may be led, by specious arguments or catchy paragraphs, to expect that perfection is at last attainable. The reality proves to be far below that standard, and the disappointed and disgusted purchaser then withdraws his support, and transfers his favours to a rival establishment. The foundation of the business in which we are particularly interested was built without the aids of the professional advertisement writer; and although the growth was slow, it was more lasting and substantial in character than that which is assisted by artificial means. Mushroom growths are worse than useless where increased business means a corresponding increase in permanent capital outlay, which remains an established liability, even if the increase that originated it is totally lost. Among other things, the amount of permanent investment should guide the commercial policy. The cheap-jack line may be financially successful where there is not much, either of cash or reputation, to lose. But gas undertakings do not come under that category. They have a large holding; and a good name is the very best advertisement they can have.

It would be interesting to know how far the sale of an every-day commodity is assisted by the buffoonery and street-boy style of humour, by parodies on nursery rhymes or popular characters of fiction or of real life, by caricature and exaggeration carried to the limits of absolute untruthfulness, excused under the plea that it will not be taken seriously, by colouring that is more likely to attract the eye than to please the artistic sense, and many other objectionable features which are prominent in posters and pamphlets, but not absent even in the advertisement columns of good-class magazines and newspapers. In placing oneself in the hands of a modern advertisement bureau, it appears necessary to decide the extent to which one is prepared to sacrifice dignity, and a reputation for truth and honesty, in the mad endeavour to attract public attention. There is no difficulty in getting talked about if no limit is laid down in these respects. But can such methods be regarded as aids to the work of establishing a really sound and permanent trade?

I have hinted at exaggeration and untruthfulness, and this may take two directions, both of which are equally reprehensible. One may minimize the cost and enlarge the advantages of his own wares, or apply a converse process in regard to his competitors. A strong point in the advertisements issued by electric supply companies is the endeavour, not only to attract attention to electricity, but to create a prejudice against gas. The literature issued in connection with the Franco-British Exhibition was a case in point. It was ostensibly intended to give information as to the advantages of electricity; but as a matter of fact, a large proportion was devoted to exaggerations of the risks attendant upon the use of coal gas, of the character of the products of combustion, &c. One can scarcely take up an electric company's pamphlet or circular that does not possess this feature; and their posters are specially designed for the purpose. That so much trouble should be taken is in itself a compliment to the strong position held by gas. Methods based upon the tricks of political candidates may be successful in selling some lines of goods; but it does not follow that they are the most efficient for extending the position already attained. We shall do well to avoid such undignified methods of attracting business, and especially playing into the hands of competitors by issuing refuting replies or rejoinders. Desperate men catch at straws; and those who have yet a position to make may find themselves under the necessity of resorting to methods that can well be disdained by gas companies, who already hold a sound business.

Is not this sort of thing largely responsible for the very slight value that is popularly attached to advertisements? Who thinks of taking them seriously, or accepting them as reliable guides? Nor are the public greatly captivated by appeals that appear by inference to be addressed to the numerous class that proverbially are soon parted from their money. Nor can much permanent benefit result from the cajoling style of advertisement, which induces the reader to act against his better judgment, and make a purchase that will cause him—figuratively, of course—to kick himself vigorously after giving the matter proper consideration. The public may be amused, but are not likely to interest themselves further in advertisements of the "no connection with the other scoundrel next door" character. I have heard of two acute hawkers of vegetables who pitched their stalls next each other in the market, and to all appearances sold recklessly one against the other, interspersing their business dealing with vituperation and abuse, but at the close of the day met privately over a friendly glass and pooled profits. This line of advertising may suit some people, but is not adapted to the use of gas companies.

Another development of modern advertising is the idea of a "present" free, gratis, and for nothing; "a free lunch to all who order a drink;" "a pound of sugar with every pound of tea;" "a hat to every purchaser of our 17s. 6d. suit;" and so on. This is becoming so largely practised that we may expect to see the time when we shall only require to buy half our necessaries; the remainder being thrown in for nothing as free presents. Is not one of the attractions of the slot-meter system the absence of any charges for rent, conveying the impression that the meter and cooker are obtained free? There is great ingenuity in the idea of giving a present that is of no use as a means of inducing a purchase that is not needed; and no doubt a substantial trade can be done (for a time) by playing upon the weaknesses of human nature. Gas companies may move ponderously and cumbrously on the commercial highway; but they can honestly claim to have kept clear of methods such as those above indicated, and they will do well to consider the desirability of jealously holding their reputation in this respect, even if their rate of increase is slower than may be desired.

I am not a believer in ready-made advertisements, to be used indiscriminately anywhere and everywhere. It seems too much like providing a regiment of soldiers with clothing all cut to one measure. The aid of the professional advertisement writer may be useful; but I cannot imagine how an artist, however clever, can design suitable matter for places that he knows nothing about. That which suits a town in Yorkshire may not be useful in Cornwall; and a paragrah that would be just the thing in Wales may be valueless in Norfolk. The writer must have an accurate knowledge of local prejudices, tastes, business habits, and turn of mind to enable him to put forward matter that will be seriously entertained and lead to good results. In some districts, statistics and results of experiments, together with any reliable information, will be carefully read and acted upon. In others, the mere fact of a leaflet exceeding (say) four pages is a certain passport for a direct journey to the waste-paper basket. I should prefer an author of ordinary business capacity, with the keen knowledge of the peculiarities of the district to be worked, even if he had never written an advertisement in his life, to an experienced writer of advertisements who did not really know the district.

An advertisement need not be unattractive because it is true. It is possible to recognize a general want, and to show how it can be met, without ever transgressing the bounds of strict truth and honesty; and the advertisement should be kept in its right place. Sometimes we hear that advertising is the soul of business. It is really only the external polish; it is a means to an end, and not the end itself. The soul, or the necessary feature, of business is a useful article at a popular price. We want our customer to feel that he gets value for his money, and to be satisfied both as to the quality of the article and the price he has paid. It is rightly observed that a satisfied customer is the best advertisement. In considering catchy posters or paragraphs, attractive leaflets, and so on, we must not lose sight of the importance of a good article at a moderate price, of prompt attention to orders and complaints, and of strict attention to business.

TOWN GAS FOR RAILWAY CARRIAGE LIGHTING.

[COMMUNICATED.]

THE lighting of railway carriages by compressed coal gas is a matter which should not be overlooked when extensions of gas sales are under consideration. Where a railway company are not entirely pledged to oil gas or electricity, it should not be impossible for coal gas to gain a trial.

The Isle of Wight Central Railway have lately been using gas from the local Gas Company's mains at Newport. This is the only British railway which is using town's gas in a highly-compressed state. Mr. R. Guest, the Locomotive Superintendent, is responsible for the introduction of the system, which has met with much success. A few details will be of interest. The gas is compressed by a pair of Westinghouse brake pumps, the first of which partially compresses the gas, while the last finally raises it to a pressure of 150 lbs. per square inch. The compressed gas is stored in five cylinders each 9 ft. by 20 in. diameter, from which the coaches are charged to a pressure of 105 lbs. At present this system is only under trial; but from Mr. Guest's remarks, there is little doubt it will be extended. Four coaches, containing in all 19 upright incandescent burners and fitted with six storage cylinders, varying in size from 6 ft. 4 in. by 20 in. diameter to 9 ft. by 20 in. diameter, are now in use. The burners, of the same size as those employed with success on the French Railways, are made by the London Lamp-Works Company.

It is found that a light of 25 candles may be obtained from a consumption of 1·63 cubic feet of gas—a result which does not compare very favourably with those published by Mr. Riley, of the Swindon Gas-Works, or with those obtained at Havre by the Western Railway of France. The reason for this may be that, being of the upright type, the burners do not give the same efficiency as those of the inverted type, which were exclusively used in the two latter cases mentioned. Details as to the renewal of mantles show that in a test of 23 days' duration, during which the coaches travelled a distance of 2350 miles, 4 mantles out of 19 in use had to be renewed. The burning hours were 4½ each night; so that the burning life of each mantle, based on this result, would be 491 hours, though it is hardly correct to state the result

in this way, for the 19 mantles in use would have deteriorated, though not sufficiently to cause their renewal. The installation of this small plant was quite inexpensive; costing not more than £55 in all. Had the Worthington brake pumps not been in stock, a small belt-driven air compressor would have been installed. This would have been a good deal cheaper, and would have been more suitable for the purpose.

The use of compressed town's gas has many advantages over oil gas. In the first place, the capital charges on the latter would have been extremely heavy. Mr. Guest states that the smallest oil-gas plant that he could have procured would have cost from £800 to £1000, as compared with the small outlay of £55 on the compressing plant. Now that incandescent mantles have been well and successfully tried in railway carriages, the position of town's gas as a suitable medium for this purpose has vastly improved. In past days, when a flat-flame burner must have been used, anything but oil gas was quite unsuitable, owing to the very limited size of the storage cylinders. Oil gas, as generally used by railway companies, will give a light of 8 candles per cubic foot—a result at least two-and-a-half times greater than that obtained with a flat-flame burner from town's gas. But now that incandescent gas-burners may be adopted with advantage, the storage question is no longer a serious bar to its use, for a light of over 20 candles may be obtained, with a consumption of 1 cubic foot of town's gas. This result has been well exceeded by the Western Railway of France, and by Mr. Riley, of the Great Western Railway Company.

It may be noted that M. Naudé, of the Havre Gas-Works, in reading a paper on this subject in 1905, stated that the lighting of railway carriages by compressed coal gas was far cheaper than by oil gas. This should be remembered by many gas companies well situated for supplying railway companies. To compare with oil gas, coal gas must, when compressed, be at least two-and-a-half times cheaper in price (and to show an advantage, it should be nearer three times cheaper); for the charging of the storage cylinders would have to be more frequent, and so cost more for labour. As to the cost of oil gas, it is difficult to get any reliable figures; but to make 1000 cubic feet, about 13 gallons of oil are required. At 3½d. per gallon, this item alone would amount to 3s. 10½d. per 1000 cubic feet, and would probably be heavier, owing to the fact that oil, unless bought in large quantities and obtainable on waterside premises, would cost considerably more than 3½d. per gallon.

Messrs. Piutsch's Patent Lighting Company, who have made a speciality of this work, state, in one of their handbooks, that oil will cost from 4d. to 6d. per gallon; so that the figure as taken at 3s. 10½d. must be considered well within the mark. Labour on manufacture is a small item; but not so wear and tear. One man per shift will look after a good-sized plant, and do all the firing-up of the furnaces (not including the firing of the boilers, if steam-engines are used for compressing the gas). The iron retorts, of which two are placed in one setting, will only last about nine months; and as the furnaces are invariably of the direct-fired type, renewal of the entire setting is a continually recurring expense. Fuel must be a fairly heavy item; but not so the scrubbing and purification of the gas, which is inexpensive, The capital charges per 1000 cubic feet are undoubtedly very high; while the bye-products—tar and hydrocarbon—are not saleable at a very remunerative rate.

The compression of rich oil gas is the direct cause of a heavy loss, owing to the condensate which is formed at high pressure. Oil gas, originally of 56-candle power, will deteriorate to 40-candle power or thereabouts on being compressed to a pressure of 150 lbs. per square inch. The condensed liquid formed during this process is the above-mentioned "hydrocarbon," which, to all appearances, would seem to be of the same nature as benzol; but when employed in a carburettor, it has one objectionable peculiarity which renders its use undesirable. The resulting gas, though satisfactory in all other respects, throws down a deposit, which, in time, is found to clog up the diaphragms of meters. Until this fact was discovered, the hydrocarbon could be disposed of at a good price; but now it is usually exported to Germany, and there fetches about 30s. per ton.

The writer is informed that the cost of oil gas varies very largely in the different railway companies, not so much on account of the different conditions prevailing as owing to the indifferent management of what is looked upon as a sort of "side line." In any case, it is an expensive process, which, after the successful introduction of incandescent mantles, is no longer justifiable. Coal gas, supplied at a price under 2s. per 1000 cubic feet, would, in all cases, undoubtedly be cheaper, unless the bugbear of a heavy capital expenditure in the past on oil-gas plant renders this course impossible owing to a large unremunerative charge for interest. Railway companies would be excellent consumers, taking a large portion of their consumption before pressure time; and for this reason, and owing to the extent of their consumption, a large rebate would be justified.

The Manchester and District Junior Gas Association have been invited to visit, on the 9th prox., the Bradford Road Station of the Manchester Gas Department. Mr. J. G. Newbigging, the Gas Engineer to the Corporation, has promised to personally conduct the party over the works; and previous to doing so, he will give a brief description of the various matters of interest. After the inspection, he will entertain the members at tea.

A PHILOSOPHICAL TREATISE ON WATER.*

On taking up this bulky tome, one is at first tempted to ask how such a simple element as water can justify so much letterpress, and whether the material provided can possibly justify a price which in these days must be considered as unusually high for a work of this nature. On discovering that the author is engineer in charge of a large provincial water-works, it is only natural to assume that he has in his book collated a comprehensive collection of scientific information relative to the element he has to deal with. However, a glance at the preface will soon correct this error, and drive the reader to seek in the book itself a solution of the questions prompted by a glance at the title and the bulk of the volume.

The author says: "This book does not pretend to be a scientific record; it is simply an ordinary person's interpretation of what he sees in Nature." Now, though it can hardly be admitted that the author is justified in describing himself as an "ordinary person," it is undoubtedly true that throughout his book he has done his best to deal with his subject from the popular point of view, or that of an "ordinary person." His confession that, in reading the works of "writers who have the happy gift of imparting useful information in a pleasant and agreeable way," he has "derived much profitable amusement," reveals the object with which he has undertaken his task; and his attempt to emulate those writers must be described as eminently successful. The main object of the work is, however, well explained by the author as being, "that others may be encouraged to a greater curiosity about such things, and find therein both greater interest and reverence for the Great Author of all." And while, in carrying out this intention, the author sometimes approaches more nearly to the purely religious aspect of his subject than one would expect from an engineer, still the general result of his efforts is best described by the heading to the present article.

Now it will no doubt be questioned whether such a treatise is likely to appeal to the practical or scientific mind of the technical water expert, be he water-diviner, geologist, analyst, engineer, or scientist pure and simple. But such a reader will find a mine of data relative to every branch of science, in which this almost universal element is concerned; and though he may, perhaps justly, complain of some want of sequence, and prefer to find his scientific information untrammelled by philosophical observations and conclusions, nevertheless he will be compelled to admit that the author has succeeded to a very remarkable degree in combining two aspects of his subject which are usually (though most erroneously) considered antagonistic—namely, the scientific and the philosophical. In these modern days of ever-broadening thought and of ever-widening research, such a combination of philosophy and science as will be found in the pages of this book may be taken as a sign of the times; and we think that both the scientist and the philosopher will be the better for studying any subject which lends itself to treatment from this dual aspect.

The universality of water in one form or another, and its many useful purposes in the economy of Nature, are no doubt realized to some extent by all; but until one finds them dealt with comprehensively in one work, it is impossible for the mind to grasp the important part taken by water in the history of the world, and particularly in that of all living things. When one follows the investigation sufficiently far to realize the complexity of those natural laws which enable man to apply such a universal element as water to industrial or domestic purposes in every-day use, the effect on the mind is not only useful and educational, but also fascinating in the extreme.

It is, of course, impossible to indicate, even in the briefest form, the many subjects which the author here presents in such an interesting fashion; but it may give an idea of the comprehensive nature of his work to state that, commencing with the creation of water in the evolution of the solar system, he deals with almost every known phenomenon in Nature and in engineering in which water plays a part, and in the later chapters presents a survey of water-works design and management which, if published alone, would rival many standard text-books dealing with the subject. This latter portion is based upon the author's personal observation and experience; and while sufficiently technical and practical to prove of interest and value to water engineers, it is written in a style which cannot fail to attract the "ordinary person" for whose benefit the book was mainly written.

In the chapters dealing with natural phenomena, the author relies, of course, very largely upon data, and sometimes upon extracts quoted from other works; but no apology is needed for doing so in the case of a comprehensive treatise of this character—and, indeed, the author's very original comments on the natural wonders he describes would excuse a much larger proportion of "cuttings" than he actually makes use of. Not content with combining science, philosophy, and religion, the author goes even further by invoking the aid of photography to illustrate some of the most picturesque marvels of Nature to which he refers. The photographs of mountain and glacier scenery supplied by Mrs. Aubrey Le Blond (Mrs. Main) add both charm and value to the book, and published by themselves would command a ready sale as splendid examples of the photographer's art. Taken in conjunction with a popular description of the natural laws governing

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* "Water: Its Origin and Use," by William Coles-Finch. London: Alston Rivers, Limited; 1908. [£1 1s.]

the formation of glaciers, snow-capped mountains, lakes, rivers, springs, clouds, ice, and snow, they afford both instruction and amusement of the highest class; and to those fortunate enough to be able to visit the scenes represented the effect must be particularly fascinating.

It would be hypercriticism to call attention to a few obvious misprints which will be noticed by the careful reader, and which will no doubt be eliminated in future editions; but one cannot refrain from wishing that the book had been published in three or even four volumes rather than in one of over 500 pages, which is needlessly clumsy and heavy to handle. In these days, when travelling occupies such a large proportion of one's time, and affords the most convenient opportunity for reading, large and heavy books are especially objectionable. The paper used for the letterpress compares rather unfavourably with that on which the illustrations are produced; and the contrast in colour is somewhat distracting. The expert writer may also be somewhat critical of the author's disconnected style, and the rather purposeless subdivision into paragraphs; but all such criticism will be silenced when the reader has grasped the obviously high purpose with which the author has carried through his onerous task, and more especially when he has been led, by contemplating the wonders of Nature, to appreciate and reverence the omnipotence and love of Nature's God.

PROGRESS OF KIRKBURTON GAS UNDERTAKING

KIRKBURTON is situated about six miles from Huddersfield in a southerly direction; and its station is the terminus of a branch line controlled by the London and North Western Railway Company. It is about two miles from the once-famed Lascelles Hall, from the village club of which at one time a team of cricketers could be selected who would trounce the pick of the kingdom, as any writer versed in cricket lore will tell.

It is not favourable to the progress of a town to be the *cul-de-sac* of a railway; and so the development of Kirkburton is of the slow and sure, rather than the mushroom, order. Last year was the Jubilee of its gas undertaking, which was formed in 1857; and the Directors of the Company celebrated it in the sensible way of giving the consumers a reduction in the price of gas. It is easily comprehensible that a country gas-works will rarely adopt what are termed "modern" improvements until the adjective has been shorn of its expressiveness by years of experience in towns. It was not till 1901 that the Kirkburton gas undertaking adopted regenerative settings upon the advice of Mr. J. H. Brearley, of Longwood, who was called in in March of that year to report upon the condition of the works, and the future policy to be pursued. Although the Company were then selling about 10 million cubic feet of gas per annum, there was no exhauster; and this deficiency was remedied.

In his report at that time, Mr. Brearley also pointed out the desirability of adding to the storage plant; for while the two gasholders then in use were only capable of containing 35,000 cubic feet, the maximum day's output often exceeded 80,000 cubic feet. In the light of subsequent events, it may be interesting to quote one or two sentences from this report—

> **The storage should be equal to not less than one-and-a-half days maximum output, whereas at present you have not one-third that capacity. In the dark days of winter, the strain upon the works, and upon the manager, must be constant. . . . Good storage accommodation conduces to economical working; for whereas at week-ends the retorts are in your case many times idle, and fuel practically wasted in keeping up the heats of the beds, with holder accommodation they could be worked throughout the week.**
>
> **Your gasholders are only capable of giving a little over 2 inches pressure on the district. In these days of cooking and gas-engines, a higher pressure is desirable, especially when the works are situated at a higher altitude than a portion of the district of supply.**

Mr. Brearley went on to point out the favourable position that the undertaking held with respect to the financial aspect of his recommendations; for Kirkburton at that time had the lowest capital (£586) per million cubic feet of gas sold in Yorkshire by undertakings of less than 16 million cubic feet output. Briefly, his recommendations were: First, improve the carbonization plant; second, increase the storage; and, third, supplement the scrubber with a washer-scrubber. As already indicated, the first suggestion was adopted in the same year; and the second has only just been put into practical operation. In the meantime, the sales have increased to 12,600,000 cubic feet; and the difficulties of working during the winter months have been accentuated, while the extension of the use of gas for cooking and heating has caused complaints of shortage of supply, due, of course, to shortage of pressure rather than inadequacy of mains.

The Directors of the Company again consulted Mr. Brearley about Midsummer this year; and, as a result, he was commissioned to prepare plans and invite tenders for the construction of a two-lift spiral-guided gasholder to be erected in a new steel tank. Six tenders were received; and the successful firm was Messrs. Robert Dempster and Sons, of Elland. The tank is 65 feet diameter, and the lifts 63 feet and 61 feet respectively. The working capacity of the holder is 116,000 cubic feet. The foundations were put down by Messrs. John Radcliffe and Sons, of Huddersfield. They consisted of concrete of specified proportions, 2 feet in thickness. As the gasholders previously in use had supplied the district without the intervention of a station governor, it has also been necessary to put in a new governor—the one adopted being Braddock's compensating governor, to accommodate which a small house has been erected. The approximate cost of the whole of the alterations is about £2000, which includes a considerable length of connections between the works and the site of the new holder. The sales of gas this year will be not less than 13 million cubic feet; and the capital spent on the works, including the cost of the alterations undertaken this year, will be about £10,800. So that, though the Company are well equipped for future extensions (excepting in the matter of scrubbing plant), the ratio of capital to turnover is very favourable for a small works.

On Wednesday of last week the Directors of the Company met to "inaugurate" the new plant. Mr. A. Carter, the Vice-Chairman, called upon Mr. Arthur Matthews, the Chairman, to turn on the valve to the new holder. Before doing so, Mr. Matthews expressed his satisfaction with the manner in which the work had been carried out. He paid a tribute to the Contractors' workmen; for, he said, not a single man engaged on the work had been seen the worse for intoxicants. A vote of thanks was accorded Mr. Matthews; Mr. Brearley proposing it, and Mr. E. J. King (Messrs. R. Dempster and Sons) seconding. Subsequently dinner was served at the Junction Hotel, after which a number of toasts were proposed and responded to, among which was that of "The Officials," responded to by Mr. Fred. Kaye, the Secretary, and Mr. Albert Whiteley, the Manager.

THE USE OF COKE-OVEN GAS.

AT a Meeting held on the 4th inst., of the Société des Ingénieurs Civils de France, a paper was read by M. CUVELETTE, on the use of gas from coke-ovens.

He stated that the problem of the direct utilization of (to adopt the convenient French phrase) "industrial gases"—that is, blast-furnace and coke-oven gases—only dates from about ten years ago. The first tests were made in 1898 at the Cockerill works on a 600 H.P. gas-engine. The results were most remarkable; the thermal yield of the engine being 30 per cent., while that of the steam-engines was not more than 12 per cent. The chief difficulty was with the dust in the gas; but this was eventually overcome by the adoption of centrifugal fans injecting water, followed by purifiers which reduced the dust to 0·02 gramme per cubic metre. Large installations of several hundreds of thousands of horse power have now been put up.

On similar lines, and under favourable circumstances, the gas from coke-ovens could be made as important as that from blast-furnaces. If the production of a ton of cast iron frees a thermal energy of two million calories for use in gas-engines, the manufacture of the same amount of coke would leave for disposal one million calories. But considerable progress has already been made in substituting hot air and regenerators for cold air in coke-ovens; and thus 40 to 50 per cent. of the gas made is now utilizable in engines. The first regenerative system was that of the Otto-Hoffmann oven, which has been used in America for the production of town gas from ovens instead of retorts, and in Austria and Germany for direct use in engines.

There are two general types of ovens: Those with special regenerators to each oven (as in Koppers' system), and those with regenerators common to a whole bench (as in the Otto, Coppée, and Collin ovens). The proportion of gas able to be utilized represents about 50 H.P. per oven. The author then points out that gas from coke-ovens would have to be purified of its tar, sulphur, and cyanides before being used in engines, which would otherwise be quickly thrown out of use, as has already been found in some cases of failure. He subsequently proceeds to describe the methods adopted (which are well known) for effecting purification of coke-oven gases. Deprived of its impurities, the gas is exceptionally rich in hydrogen—from 55 to 60 per cent.

Apart from improvements in the construction of the engine, there should be perfect purification of the gas; oils should be used which do not leave any solid residue; and an experienced staff should attend to the machines. At present on the Continent there may be such engines developing altogether 40,000 H.P.; the maximum being of 1200 H.P. to 1500 H.P. It has been proved that the kilowatt can easily be obtained with a consumption of 1 cubic metre (35·3 cubic feet) of gas of 4000 calories. With boilers and turbines, there would be a consumption of about 2·5 cubic metres. The net cost per kilowatt-hour is approximately the same; but in the former case there would be more than double the power available than in the latter.

The importance of the direct utilization of coke-oven gas in an explosive engine is unquestionable; and the small number of engines hitherto used for this purpose is partly due to the high cost of the engines, and also partly to a certain misconception in regard to the subject.

The President of the French Society of Civil Engineers (M. Reumaux) referred to recent great progress in the construction of large gas-engines, and said it was undoubtedly to the interest of coke manufacturers to arrange their ovens so as to consume as little gas as possible in the carbonization. They should economize their important bye-product, gas, to the greatest extent possible, and dispose of it, as both theory and practice dictated, in the best way—by using it in engines. The future lay along such lines.

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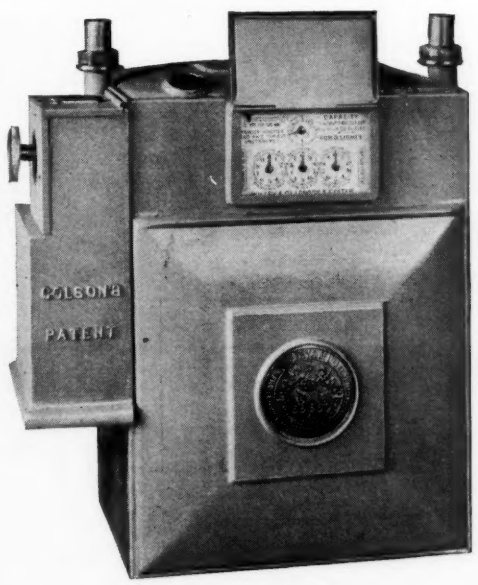

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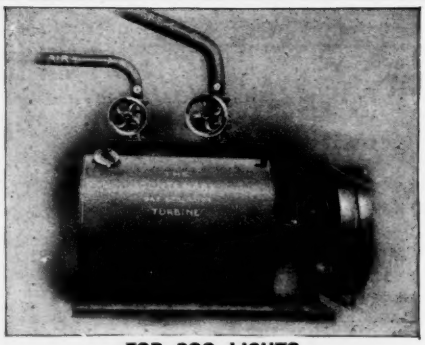

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WATER AFFAIRS.

Review of the Principal Events of the Year.

In passing in review the most noteworthy events in connection with the supply of water in the year now drawing to a close, we do not find that they have been of such a nature as to render the period conspicuous in the records of the progress of this important branch of the public service. A number of matters of interest have, however, been noticed in our columns in the course of the twelve months; and to these attention may be again directed.

As the condition of the weather has a marked effect on water supply, it will not be out of place to devote to this subject—which has of late years been brought much more prominently under public notice than of old, through the medium of the meteorological reports in the Daily Press—a few lines by way of introduction to our review. The year 1907 closed, and the present one opened, with very cold weather; Sunday, the 5th of January, being the coldest day we had had for twenty years. At 9 p.m. the thermometer registered 20° Fahr.; but within twenty hours the temperature rose to the remarkable extent of 30°—the thermometer marking 50° at 4 p.m. next day. On the 7th, the weather was quite mild; and there was rain in the evening. One effect of the cold snap was to obstruct the leat by means of which Devonport obtains its water—an unfortunate event which marked the opening of the preceding year. The consequence was that the supply had to be considerably curtailed until a thaw brought the leat into its normal condition, when the full service was resumed. The inconvenience attending this interference with the supply emphasized the necessity of proceeding with the laying of a line of pipes to supersede the leat, and thereby obviate any similar troubles in future. The effect of the frost was to direct the attention of the Corporation to the advisability of hastening the construction of a new storage reservoir, as recommended by the Water Engineer (Mr. F. W. Lillicrap) in a report presented by him to the Water Committee. While the leat was frozen, and the borough was drawing upon the Plymouth stores, the trunk main serving the latter town burst at Roborough, some four or five miles from the two places; and the auxiliary supply to Devonport had to be discontinued, while Plymouth itself was threatened with a shortage of water. The service was kept up through the damaged pipe as well as through the disused leat; and though the loss by leakage was very great, some of the water reached the reservoirs. The break occurred on the 6th of January, and five days later it was found possible to undertake the necessary repairs, and resume the supply to Devonport. This accident demonstrated the wisdom of the Corporation in deciding to duplicate the trunk main, which their Water Engineer (Mr. F. Howarth) estimated would be done at about £2000 less than the amount originally asked for, owing to the exceptionally low price of iron pipes. This important work was completed in the summer, and tested with very satisfactory results.

The short spell of frost was severely felt in Liverpool. The rapid thaw which occurred on the night of the 5th of January produced a great number of leakages from burst lead pipes in dwelling-houses. No fewer than 2852 were dealt with in one week; and from the commencement of the frost 96 iron pipes (chiefly small distributing mains) were broken. In the week ending on the 11th, the consumption (and waste) of water amounted to 263½ million gallons, or about 84½ million gallons more than in the corresponding week of last year—an increase to the extent of 47 per cent. The consumption on one day was 47 million gallons, compared with a daily average of 26 or 27 millions. The pumping-engines had to be kept hard at work so as to maintain the supply; but the stock of water in the Prescot reservoir was nevertheless reduced by 57 million gallons. The difficulties were increased by an unfortunate fracture on the Rivington pipe-line, to repair which it became necessary to shut off for about three days the supply from this source. As was pointed out by the Deputy-Chairman of the Water Committee (Colonel Porter), at the monthly meeting at which the preceding particulars were brought forward, the accident emphasized the enormous advantage of the second pipe-line to Vyrnwy, whence the Committee had been drawing about 24¼ million gallons of water daily. Had it not been for this pipe, Liverpool would have been in a precarious position.

As in previous years, we will commence our retrospect with the Metropolis, and glance at the year's work of the Water Board. The first meeting after the Christmas recess was a melancholy one, for the Board had, only a few days previously, been deprived of the valuable services of their Comptroller (Mr. F. E. Harris) by his sudden death. Lord Welby, the Chairman of the Finance Committee, at the request of the Chairman (Sir Melvill Beachcroft), moved a resolution expressing the Board's high appreciation of their late Comptroller, and conveying to his widow and family their profound sympathy with them in their bereavement. At a subsequent meeting of the Board, Mr. Arthur Newton, the Deputy-Comptroller, was promoted to the position occupied by his late lamented chief. An important change in the administration of the affairs of the Board was the resignation by Sir Melvill Beachcroft of the chairmanship, which took place towards the end of May. Sir Melvill had occupied this position since the constitution of the Board five years previously; and in looking back over the work done during this period, he said he could not but regard it with satisfaction. He had hoped to remain Chairman until the great scheme for providing adequate storage for the Metropolis had been inaugurated; but he found it was no longer possible to make the pecuniary sacrifice which such devotion to the public service entailed. His resignation was received with extreme regret by his colleagues, who tendered him their hearty thanks for the great services he had rendered. Mr. E. B. Barnard, M.P., the Vice-Chairman, and Chairman of the Works and Stores Committee, was unanimously chosen as his successor; Mr. G. S. Elliott, the Chairman of the Appeal and Assessment Committee, being elected to the position vacated by Mr. Barnard.

In view of the remarks made by Sir Melvill Beachcroft on the provision of additional water storage for London, it must have been very gratifying to him to assist at the inaugural ceremony in connection with, at all events, one section of a scheme devised with this object. On the 11th of April, he presided at the cutting of the first turf of a large reservoir at Chingford, having a water area of 416 acres, and capable of containing, approximately, 3000 million gallons. It is to be filled from the River Lea and the Lea Navigation; and the former will have to be diverted by a new channel three miles long and 55 feet wide. The works were originally designed for the East London Water Company by their Engineer, Mr. W. B. Bryan, M.Inst.C.E., who is now the Chief Engineer of the Board. Other important works commenced later in the year were a large storage reservoir at East Molesey and a pumping-station at Walton. The former was authorized by an Act obtained eight years ago by the Lambeth Water Company, and was originally designed by their Engineer (Mr. T. F. Parkes). It was, however, modified by Mr. Bryan; and it will now have a water area of about 120 acres, and a capacity of nearly 1000 million gallons. The pumping-station is in connection with the two reservoirs at Walton which were completed in the spring of last year. It was not originally proposed to begin the Molesey reservoir and the pumping-station this year; but, as the result of a communication received from the Local Government Board—the President of which (the Right Hon. John Burns) was present during a portion of the inaugural ceremony—the Board put it in hand with the view of giving work to the unemployed. Mr. Burns, in a long and interesting address, expressed his great pleasure at assisting at the inauguration of a "great, necessary, and "useful public work," and highly commended the action of the Board in ante-dating it in the interests of the workers. At the meeting of the Board held on the 13th of March, the Works and Stores Committee reported that it would be necessary to authorize the expenditure of £70,368 in excess of the estimate of £152,400 already sanctioned to complete the Staines reservoirs communication works, the total cost of which would be £1,214,392; and towards the close of the year, the Board sanctioned an expenditure of £7000 in strengthening and increasing the capacity of the Honor Oak reservoirs.

During the year the Board have found, as their predecessors did, that the supply of water entails upon those who undertake it not only a great deal of responsibility, but sometimes a considerable amount of abuse, even when they are only carrying out the duties imposed upon them by Parliament. The coming into force, on the 1st of April, of the Board's Charges Act of last year, whereby they were

empowered to levy an all-round rate of 5 per cent. on the rateable value of the premises supplied, gave rise to an agitation in the City, where the increased charges press most heavily owing to the nature of the property, such as had scarcely been equalled during the *régime* of the Water Companies. Where practicable, owners of property sank wells, and occupiers resorted to neighbouring pumps, to obtain the small quantity of water required in their business, for which they had been called upon by the Board to pay what were characterized as exorbitant rates. The late Sir George Livesey gave in "The Times" an example of the changed conditions in the case of the South Suburban Gas Company. They had been paying £49 per annum for their water, which was supplied by meter, and they were called upon by the Board to pay £884 for it (which was 5 per cent. on the Company's assessment), or at the rate of 18s. for a shilling's worth of water. The Company declined to agree to this, and proceeded to sink a well. A prominent objector in the City was Mr. Vivian Samuel, who determined to cease taking a supply of water from the Board, and get what he required from Aldgate pump. The agitation culminated in a meeting held at the Mansion House on the 28th of October, to "protest against the excessive "charges made by the Board;" and among the resolutions passed was one urging upon the Corporation of London, the County Council, and the Metropolitan Borough Councils the importance of instructing their representatives on the Board to support a reduction of the charges or an increase in the rebate allowable under the Act, so as to afford some measure of relief to the consumers. Copies of the resolutions passed were sent to the Board, and also to the President of the Local Government Board, the London County Council, and the Metropolitan Borough Councils; and at the meeting of the Board on the 20th of November they were dealt with in a long report presented by the Appeal and Assessment Committee. They pointed out that, from the earliest consideration of the question, it became evident that it would be necessary to impose a charge of 5 per cent., and that upon this basis there was a net deficiency of more than £21,000 on the whole of the area supplied. They concluded by recommending the Board to reply to the resolutions, and express regret that they were at present unable to make any concession in the direction indicated; and the report was adopted without discussion.

This tacit acquiescence in the views put forward by the Committee was an indication that the members generally were conscious of the fact that the condition of the Board's finances did not allow of any concession in the way of reduction of the charges. Indeed, Lord Welby, the Chairman of the Finance Committee, had told them, before they adjourned for the summer recess, that, owing to the Charges Act, a very considerable loss was contemplated, and that the estimates for the year 1908-9 would end in a deficit. Sir Melvill Beachcroft, the former Chairman, dealt seriously with the position of the Board, and emphasized the necessity of their knowing exactly how they stood, and what were the prospective chances of meeting all their liabilities. He pointed out that fifteen years hence they would have to deal with their sinking fund, and then they would have to provide £140,000 a year, which was a disagreeable thing to contemplate. They were spending money freely, and it was only by carefully watching their expenditure that they could help going upon the rates. With this warning in their ears, the members passed the estimates, and went off on their holidays. It will be convenient to refer here to the financial position of the Board. In the spring, they issued an additional £1,500,000 of "B" stock, at an average of £90 2s. 5·95d. per £100 (the minimum being £90), which was lower than the price obtained on the first issue of this class of stock. It was required to a large extent for meeting money bills falling due. The position of the capital account on the 30th of September was as follows: Total expenditure to date, £3,240,455; total capital raised by loans or obtained from other sources, £3,501,940—leaving a balance of £261,485. At the meeting of the Board on the 18th inst., the Finance Committee presented an important report embodying the estimates by the Accountant of the income on revenue account for the year 1908-9. It was put at £2,852,350, and the expenditure voted at a previous meeting was £2,930,780; so that there was an anticipated deficit of £78,430. This was not a pleasant reflection for the Board to adjourn with for the Christmas vacation. Various things—the operation of the Charges Act, empty houses, and the decrease of building—combined to produce this unfortunate position of affairs. However, the Board accepted the explanation offered by Lord Welby, as given above, passed the estimates, and went on their way.

Turning from the Metropolis to the Provinces, it will be of interest to notice briefly the larger schemes of water supply to which reference has been made in the "JOURNAL" during the year. The first number contained the announcement by the Glamorgan County Council that they then had under consideration a scheme for the constitution of a central authority for the supply of water to the whole of the Administrative County; and they suggested that Cardiff and Swansea should be included. The scheme had been reported upon at some length by Messrs. Middleton, Hunter, and Duff, of Westminster, whose names will doubtless be remembered in connection with the large scheme of reservoirs carried out at Staines a few years ago. These gentlemen recommended the formation of a Water Board for the whole of the county, including Cardiff and Swansea, to be composed of members appointed by the Local Authorities concerned, whose sources of water were to be purchased. A private conference was held in the summer between representatives of the County Council and the various District Councils, with the result that an Executive Committee was nominated to frame a scheme and formulate the heads of a Bill to be introduced next session to sanction the formation of the proposed Board. This was accordingly done, and an outline of the scheme was given in the notice of the Bill which appeared in the "JOURNAL" for the 1st inst. In the meantime, the Corporation of Cardiff had been taking steps to augment their water supply, and negotiations were entered into with the Merthyr Corporation for a partnership scheme for providing a new reservoir at Pontsticill, in the Taff Fechan Valley; but, owing mainly to the difficulties of dual control, they fell through. Something, however, had to be done for Cardiff; and the Town Council turned their attention to the Severn Tunnel, the water pumped from which, would, it was thought, afford them the required relief, and obviate the necessity for the construction of a third large reservoir. But, as the result of a report by Mr. C. H. Priestley, their Water Engineer, they came to the conclusion that the scheme was impracticable; and they decided to apply to Parliament for authority to construct a reservoir on the Taff Fawr, and pipe-lines and other works in connection with it, at an estimated cost of £235,000. In the summer, a proposal was made by the Abercarn District Council to form a Joint Water Board for the district; but it was never carried out.

One of the most important events of the year, at all events so far as the Midland Counties are concerned, was the completion, in September, of the works to enable Coventry to obtain a much-needed supply of water from Birmingham. When the Midland capital was in a position to avail itself of the water furnished by the great works in the Elan Valley, the Corporation were enabled to dispense with the supply from Shustoke. An arrangement was accordingly come to by which Coventry will receive a minimum quantity of 840,000 gallons a day, and pay £5000 a year for the water taken. The new supply is obtained from the watershed of the River Bourne, filtered at Whitacre, and pumped through 12 miles of mains from Shustoke to the reservoirs of the Coventry Corporation at Coundon. The scheme, which entailed an outlay of £81,000, was an example of smart work; for the Royal Assent to the Bill sanctioning it was not given till August last year. It was carried out by the Water Engineer (Mr. J. E. Swindlehurst), with Mr. Charles Hawksley as Consulting Engineer; and on the occasion of the inaugural ceremony both were complimented on their achievement. Away in the spring, the town of Selby—noted for its magnificent Abbey, which was seriously damaged by fire rather more than two years ago—was provided with a new water supply, furnished by works carried out under the joint supervision of Mr. Percy Griffith, M.Inst.C.E., of Westminster, and Mr. Bruce M'Gregor Gray, Assoc.M.Inst.C.E., the Engineer and Surveyor to the Urban District Council. The opening ceremony was performed on the 30th of April by Mr. Mark Scott, the Chairman of the Council, who emphasized the fact that the completion of the works, for which they had had to fight very hard, and which had cost £30,000, would prove a great boon to the town for many years to come. An important feature of the scheme is the provision of fire-hydrants, served from the new reservoir, which will command every part of the Abbey, and enable jets of water to be thrown over the roof without the assistance of a fire-engine. Among other completed works, mention may

be made of a new Corliss pumping-engine at the Widnes Water-Works, started by Mrs. Timmis, wife of the Chairman of the Gas and Water Committee, early in July. It was erected, under Mr. Isaac Carr's supervision, by Messrs. Hathorn, Davey, and Co., of Leeds, and forms part of an extension scheme which will cost altogether about £15,500. Schemes for water supply for Brixham and Teignmouth were completed in the summer; new water-works for supplementing the supply to Dartmouth were inaugurated at the end of September; in the same month the formal opening ceremony was performed at the Accrington District Gas and Water Board's pumping-station at Altham, which had cost about £30,000, and will furnish a practically inexhaustible supply of pure water at the rate of about 1½ million gallons a day; a little later, the inaugural ceremony of laying a third line of pipes between Thirlmere and Manchester was performed; and a few days ago a large reservoir, capable of holding 400 million gallons of water, constructed for the Heywood and Middleton Water Board at a cost of £250,000, was brought into use.

The Corporation of Leeds have for some years had under consideration a scheme for the construction of storage reservoirs in the Ure Valley; and in the spring they decided to proceed with the Leighton reservoir, on a site in a valley down which runs a tributary of the Ure, and in close proximity to the Roundhill reservoir now being built by the Harrogate Corporation. The work was commenced early in July by the cutting of the first sod by the Chairman of the Water Committee (Mr. F. Ogden); and when it is completed Leeds will be in possession of additional storage to the extent of 1136 million gallons, at a cost of about £437,000. The new reservoir will eventually be connected with the present source of supply in Washbourn Valley by means of an aqueduct 24 miles long. Readers of the "JOURNAL" are aware that Lincoln has for a considerable time been troubled with the question of the water supply of the city, and has expended a great deal of money in trying to improve it—unfortunately without effect. On the abandonment of the deep boring which had cost £25,000 and produced only water unfit for domestic use, the Water Engineer of the Corporation (Mr. N. M'Kechnie Barron) submitted a number of other schemes, one of which—the erection of a pumping-station at Elkesley, situated about 22 miles from the city—was selected. A Bill was promoted to obtain the necessary powers for carrying out the scheme, and, in the face of strenuous opposition in both Houses, it received the Royal Assent in August. No time was lost before taking the initial steps; and on the 24th of October the scheme was commenced by the Mayor (Mr. J. Mills) cutting the first sod, in the presence of a very numerous company, which included the Lord Bishop of the Diocese (Dr. E. King). The water obtained will be conveyed to a tank at Westgate, whence it will gravitate to a new reservoir on Cross-o'-Cliff Hill. All present at the inaugural ceremony united in congratulating Mr. Barron, and wishing success to the scheme.

Early in the year, the Exmouth District Council took into serious consideration the question of increasing the water supply of the town. They had experienced some trouble consequent on their right to abstract water from the East Budleigh Brook being disputed by certain millers, to whom they had to pay compensation. They accordingly consulted Messrs. Hill and Sons; and, as the result of their report, they decided to have some trial borings made at a spot recommended by Professor Boyd Dawkins. The outcome was a resolution to apply to Parliament for authority to construct a well and pumping-station in the parish of Colaton Raleigh and various ancillary works; and the necessary notice has been given. Towards the close of July, the Devonport Town Council decided to adopt plans and estimates submitted to them by their Water Engineer for the construction at Crown Hill of a reservoir having a capacity of 20 million gallons, at an estimated cost of £31,000. Some of the members favoured an arrangement being come to with the Plymouth Corporation for furnishing an additional supply from their reservoir at Burrator; but this was considered to be impracticable. By the end of October the work had been commenced, and it is expected to be finished in two years. Important extensions at the Tettenhall pumping-station of the Wolverhampton Corporation were inaugurated in April. They consisted of the construction of a reservoir to hold 6 million gallons and a storage-tank, the sinking of two boreholes, the building and equipment of an engine-house, and the laying of some additional pumping and trunk mains. The new scheme, which was devised by Mr. E. A. B. Woodward, the Water Engineer to the Corporation, is expected to be sufficient for twenty-five or thirty years. The works were formally started by Alderman Marston, the Chairman of the Water Committee, in the the presence of a numerous company. In the summer, a commencement was made with a new reservoir, capable of holding 500 million gallons of water, to be constructed at Delph for the Bolton Corporation, from plans prepared by Mr. R. H. Swindlehurst, their Water Engineer, and Mr. Lewis Mitchell, his Assistant. It will take some four or five years to complete, and cost about £300,000. Later in the year, fine new pumping plant was installed at the works of the York Water-Works Company by Messrs. J. Simpson and Co., under the supervision of Mr. W. H. Humphreys, the Company's Engineer and Manager.

New schemes of water supply and extensions of works of smaller proportions have been projected, commenced, and in some cases completed, during the year, for Alford (Lincs.), Appleby, Bexhill, Billingshurst, Braintree, Bridlington, Camborne, Chapel-en-le Frith, Cowdenbeath, Creswell, Dawlish (West), Dartmouth, Diss, Dunmow, Fairfield, Felsted, Gosport, Holderness, Holsworthy, Kinver, Mablethorpe, Mansfield, Maryport, Otley, St. Ives (Cornwall), South Molton, Tiverton, Torquay, Totnes, Warwick, and Wellingborough. In connection with the scheme for the small Devonshire town of Holsworthy, the District Council had to be roused into definite action by the Local Government Board. An attempt was made by Mr. Preston, whose name will be remembered in connection with the Bude and certain other gas undertakings, to secure the water supply of the town for a private Company of which he was the representative; and it was alleged that, in order to attain his object, he went so far as to offer a bribe to the Clerk of the Council. It seemed, however, there was some misunderstanding in regard to this. At all events, Mr. Preston's proposals were declined, and the Council decided to carry out the scheme themselves. Local Government Board inquiries in regard to water supply have been held during the year in connection with Braintree, Bridlington, Carbis Bay, Coggeshall, Colwyn, Dawlish (West), Glastonbury, Llandudno, Portadown and Banbridge, Portrush, Preston (Hull), Torpoint, Wallasey, and Wotton-under-Edge. At Stoke St. Gregory, a typical Somerset agricultural district, eight miles from Taunton, an inquiry was held in connection with a proposed water supply which was considered to be urgently needed, but which was objected to by several residents—principally landowners and farmers—on the ground that the district could not afford the expenditure, and that the existing river supply was a good one.

It will be convenient to refer here to the new works, extensions of limits, and increases of capital which have recently been sanctioned by Parliament. They need not, however, be dealt with at any length, inasmuch as the work of the session in connection with water supply has lately been reviewed. Taking Companies first, certain private parties were constituted a Company for supplying water within the borough of Hedon and adjacent places in the East Riding of York; and they were empowered to construct the necessary works. The Pontypridd Water Company obtained authority to carry out some important works; and they are to extend their limits of supply so as to include parts of Llantrisant and Llantwit Fardre if called upon to do so. The Rhymney and Aber Valleys Gas and Water Company also obtained sanction to construct additional works, including filter-beds, as well as an extension of time for the completion of others authorized by their Acts of 1892 and 1898. The South Suburban Water Company were granted £100,000 of additional capital, and given permission, on and after Jan. 1, 1910, to take water from the Thames and its tributaries, as well as from lands within the watershed of the river. The Camborne Water Company, by a "late" Bill, secured the necessary power to raise additional capital. Among the Local Authorities, the Ammanford Urban District Council obtained confirmation for the works at present in existence and a definition of their limits of supply; and the Audenshaw District Council were allowed to become a constituent authority of the Ashton-under-Lyne, Stalybridge, and Dukinfield District Water-Works Joint Committee as from the 25th of March next. The Corporation of Blackburn were granted permission to acquire lands for the protection of their waters and water-works. Some important transfers of works, of which details have been recently given, were authorized by the Blaydon and Ryton (Transfer) Act. The

Leicester Corporation and the Briton Ferry and Padiham Urban District Councils obtained an extension of their limits; the Burnley, Manchester, Margate, and Rochdale Corporations, power to construct additional works; and the Keighley Corporation, authority to purchase more land, and an extension of time for the completion of certain works. The Conway and Colwyn Bay Joint Water Supply Board had the construction of their existing works confirmed, but were not permitted to carry out the subsidiary works included in their Bill. The scheme for which the Lincoln Corporation obtained parliamentary powers last session has already been mentioned. By the Act obtained by the Skegness Urban District Council, they are authorized to purchase the undertaking of the Skegness Water Company, and supply water within their district as well as in certain places in the county of Lincoln. It may be conveniently mentioned here that Skegness was furnished in April with an additional supply of water from new works at Welton; the ceremony of opening the valve being performed by Mr. Percy Griffith, the Engineer to the Water Company, by whom the scheme was designed. By means of Provisional Orders, especially those applied for under the Private Legislation Procedure (Scotland) Act, 1899, authority was obtained for the construction of works, the extension of limits of supply, and the raising of further capital.

Turning to the legal business of the year, the two most conspicuous features are cases in which proceedings were taken against Water Companies for exceeding their statutory powers. The first action was one brought against the Frimley and Farnborough District Water Company by the Attorney-General, at the relation of certain landowners in the neighbourhood of Odiham and Winchfield, to obtain a declaration that the Company were not entitled to sink wells and erect a pumping-station on certain lands they had purchased by agreement in the first-named parish, and an injunction to restrain them from proceeding with these works, on the ground that they were *ultra vires*. It was contended for the Company that, as they had properly acquired the lands in question by agreement, as they were authorized to do, they were entitled to use them in any way they saw fit for the purpose for which they were constituted —viz., the supply of water within their district. On the other hand, it was pointed out that these lands were not shown upon the plans deposited when the Company were incorporated, and that therefore they had power to put upon them only works which were ancillary to their statutory undertaking, whereas those in question were in reality new works. This was the view taken by Mr. Justice Swinfen Eady; and he granted the injunction—his decision being unanimously upheld a few weeks later in the Court of Appeal by the Master of the Rolls and Lords Justices Fletcher Moulton and Buckley. The other action, which was tried by the same Judge, was brought by the Trustees of certain property at East Grinstead, to restrain the East Grinstead Water Company from laying a 6-inch main from their pumping-station at Hackenden to the west side of the property, to do which, it was contended, they had no statutory powers. A point was raised as to whether the plaintiffs could proceed without the intervention of the Attorney-General; but eventually his Lordship decided that the existing works at Hackenden were not "ancillary to the main "undertaking," but were "a new undertaking not authorized "by the Company's Act." Consequently, the defendants had no right to lay down the main in question, or any mains or pipes in or under the public footpath on the west side of the plaintiffs' property, without giving due notice to them. He therefore granted the injunction, with costs against the defendants.

An important feature of the legal work of the year 1907 was the decision given at the Hilary sittings by Mr. Justice Jelf, in an action brought by the Chester Water Company to determine whether the Guardians of the Chester Union were entitled to a supply of water for their workhouse at the "domestic" rate. The Company asked for a declaration by the Court that they were not bound to supply water to the Guardians otherwise than by meter, and for an order for the payment of £491 11s. 9d. on account of water furnished from Jan. 1, 1902, to July 6, 1904, the date of the writ. His Lordship decided in the plaintiffs' favour so far as the declaration asked for was concerned; but he said he was compelled reluctantly to come to the conclusion that they were precluded, by the provisions of their Act of 1874, from recovering any part of the sum claimed. The Guardians decided to appeal against this judgment; and the matter came before Lords Justices Vaughan Williams, Farwell, and Kennedy early in February last. At the close of the arguments, their Lordships discharged the declaration of Mr. Justice Jelf, and decided that the defendants were not entitled to require the plaintiffs to supply the workhouse with water for other than domestic purposes until they had agreed with the plaintiffs as to the terms and conditions of such supply, or, failing agreement, on such conditions as might be determined by two Justices, as provided by section 47 of the Company's Act of 1857. They also decided that the defendants were not entitled to use any of the plaintiffs' water for non-domestic purposes until such agreement or determination had been made. Another case in which the question of the "domestic" or "business" supply of water was raised was that of *Frederick v. Bognor Water Company*, tried by Mr. Justice Eve only a few weeks ago. The plaintiff, Mr. Richard Frederick, the occupier of a large house used as a boarding school, with stables and laundry attached, at Pagham, Bognor, claimed a declaration that he was entitled to a supply of water at the rates specified in the Company's Act of 1891 as those chargeable for water used for domestic purposes. The defendants contended that the plaintiff was carrying on a business upon the premises, and that therefore, in the terms of section 61 of the Act, they were not compelled to supply him with water otherwise than by agreement. In delivering his considered judgment, his Lordship said the determination of the question between the parties appeared to turn upon the construction put upon the words "for which water "is required" in section 61; and the Chester Water Company's case seemed to indicate that this must depend upon the purposes for which the water was actually used. On considering all the cases, he came to the conclusion that the keeping of a boarding school was not carrying on business "for which water is required" within the meaning of the Company's Act; and he therefore made a declaration that plaintiff was entitled to a supply at the domestic rate.

An action brought by Mr. A. Telford Simpson against the South Oxfordshire Water and Gas Company, which came before a Divisional Court, raised the question whether a Company who had supplied an insufficient quantity of water for domestic purposes to a particular house were liable to a penalty under section 43 of the Water-Works Clauses Act, 1847. The water had for eleven years passed into the house through a 1-inch pipe; but this was removed by the Company, and a ¾-inch pipe substituted for it. As the supply then became insufficient, a summons was taken out against the Company. The Magistrates at the Caversham Petty Sessions, however, dismissed it, on the ground that, as some water came through the pipe, a penalty could not be imposed. On behalf of the Company, it was argued that they could only be convicted if they neglected to supply any water whatever to the premises. If the quantity they furnished was insufficient, the remedy of the consumer was by *mandamus*, injunction, or damages. The Court, consisting of the Lord Chief Justice and Justices Lawrence and Sutton, supported this view, and decided that the offence in respect of which a penalty was inflicted under the section of the Act referred to was the actual interruption of the supply of water, and not the neglect to furnish any quantity. They were so satisfied as to the justice of their decision that they refused leave to appeal. An action was brought by the Bourne Water-Works Company against the South Lincolnshire Water Company for the specific performance of an agreement entered into for the purchase by them of the plaintiffs' undertaking; and Mr. Justice Neville decided that they were entitled to the order for which they applied. The Metropolitan Water Board and the New River Company, Limited, were defendants in an action brought by Sir F. E. Shafto Adair to ascertain his rights with reference to the yearly payment of the sum of £400, known as the "King's Clogg," which had for many years been made to him and his predecessors in title by the Company. The case occupied Mr. Justice Warrington for several days, and he eventually made an order upon the Board for payment of the sum in question, and also the amount in arrear, with interest. The Board appealed against this decision, but unsuccessfully, two of the learned Judges (the Master of the Rolls and Lord Justice Farwell) being against them, while Lord Justice Fletcher Moulton, who, it may be remembered, conducted their case through the arbitration and the legal proceedings resulting from it, expressed the opinion that the action in the Court below should have been dismissed, as against the Board, with costs to be paid by the plaintiff,

and that judgment should have been given against the other defendants, with costs.

Towards the close of 1906, some legal proceedings arose out of an award made by Mr. Wainwright, the President of the Surveyors' Institution, in regard to the price to be paid to Mr. Lucas, by the Chesterfield Water and Gas Board, for a piece of land required for a reservoir. The award was made in the form of a special case on the question of the adaptability of the land for the purpose. If, in the opinion of the High Court, this point should be considered in assessing compensation, Mr. Lucas was to have £1615; if not, the sum was to be reduced by £779. The matter came before Mr. Justice Bray about this time last year, and he decided that the claimant was entitled to the larger amount. Against this decision the Board appealed, with the result that the award was sent back to Mr. Wainwright, in order that he might value the possibility of the site in question coming into the market as being required for the enlargement of the water-works, and not on the basis of a realized possibility on account of the Board having obtained certain compulsory parliamentary powers. A question which had occupied the Courts for some time was finally decided by the House of Lords early in the year. The action was brought by the Manchester Corporation, as the owners of certain lands in Lancashire, to restrain the New Moss Colliery Company, Limited, from so working their coal seams as to let down and injure the reservoirs of the Corporation. A decision in favour of the Company was given by Mr. Justice Farwell on Dec. 12, 1905, and a year after, almost to the day, it was reversed by the Court of Appeal. Thereupon the Company took the matter to the House of Lords, and the arguments were heard at the end of January. A month later their Lordships dismissed the appeal, with costs.

Among the smaller legal cases of the year the following may be mentioned: The widow of the farm bailiff at the Three Counties Asylum, near Arlesey, in Bedfordshire, obtained £650 damages from Mr. F. Noel Butler, the Clerk to the Committee of Visitors to the Asylum, for the loss of her husband owing to the negligence of the defendant in supplying to her house impure water drawn from wells. A water consumer at Sunderland objected to paying the charge for a bath in his house, on the ground that no tap was fixed above it—this having been purposely unscrewed by the landlord. There were, however, two taps, for hot and cold water (from which water could have been drawn) close to the head of the bath. The Bench decided that, as there was a bath in the house, the occupier must pay for it, whether he used it or not. In a case heard at the Mark Cross Petty Sessions, the question at issue was the level at which the water was "delivered;" the supplying Company being entitled to charge 50 per cent. extra if the delivery was at a greater height than 700 feet. The Company contended that the "delivery" of the water took place at the cistern in the roof, which was above the 700-feet level; while the defendant argued that it was where the supply-pipe entered the house, which was below it. The decision of the Bench was against the Company; but they agreed to state a case. A quarry-owner of Settle recovered compensation from the Earby Water Company for damages sustained by him owing to the cutting off by them of the water supply to a hydrant at Grove Shed, Earby, with the result that it was impossible to extinguish a fire which occurred there a few weeks afterwards. The occupier of a stable, who took his horse to a public water-trough, was ordered to pay for the water drunk by the animal just as if it had been drawn from a tap in the stable. The Metropolitan Water Board figured in the Lower Courts on various occasions, Early in the year, they were summoned by Mr. J. B. Kyffin. the owner of houses in Nesbit Street, Hackney, for cutting off the water supply from two of them. It was, however, decided that the Board were justified in their action, and the summons was dismissed. The Board had trouble with Mr. Kyffin again in the spring, as he had unlawfully connected the service-pipe of one house with the water-fittings of another, and allowed the tenant to take water, without the Board's consent. He was fined 40s., with £2 2s. costs. In a subsequent case, he had to pay 5s. and £1 1s. costs. The Board were successful in proceedings taken against a number of consumers at Surbiton whose water-fittings were not in accordance with the requirements. There were 3500 premises in the town, and only 1100 of the fittings were right. But, on the other hand, for "negligently allowing a "fitting in the highway to be defective," causing injury to a pedestrian—the "fitting" in question being a stopcock box from which the lid had been removed by somebody—the Board had to pay twenty guineas compensation and costs. A novel question arose on the hearing, at the Lambeth Police Court, of a summons taken out by the District Surveyor for Camberwell against the Contractors for a reservoir, for the recovery of £297 10s., fees alleged to be due under the London Building Act. The claim was made in respect of two covered reservoirs constructed at Nunhead for the Metropolitan Water Board, which it was alleged came within the definition of "a building of the warehouse "class." The Surveyor obtained his fees and costs; but the Contractors have appealed.

The question of liability for damage to roads caused by heavy traffic came up on several occasions during the year 1907 in connection with reservoir works being carried out by the Sutton Water Company. In one case, an appeal to a Divisional Court from the decision of a County Court Judge resulted in an order to the Contractors to refund to the Company an amount they had been called upon to pay to the Croydon Rural District Council in respect of damage to a road. The question turned upon the construction of a clause in the specification attached to the contract; and this came before the Court of Appeal in March last, on an appeal by the Contractors, who, however, were not successful. Early in the year, Mr. Justice Lawrance and a Special Jury were occupied for eleven days in trying an action brought by Dr. Fergusson, the proprietor of a hydropathic establishment at Malvern, against the Urban District Council for damages for alleged nuisance in allowing his drinking water to be polluted by sewage escaping from their sewers, whereby an outbreak of typhoid fever in his hydro was caused, from which two of the visitors and two servants died. He was successful in his action; but the Council appealed, mainly on the ground that, upon the findings of the Jury, the verdict was against the weight of evidence. They also submitted that the Jury had been misdirected. The Court of Appeal failed to see any breach of duty on the part of the Council, and they decided that judgment should be entered for them, with costs. The case has, however, been taken to the House of Lords. Partaking as it does of the nature of legal proceedings, reference may be made here to an arbitration between the Warrington Corporation and Mr. George Lawson, who had taken a contract in connection with their water-works. The claim amounted altogether to £71,909, and the Corporation counterclaimed for £8000. The matter went first into Court and subsequently to Mr. G. H. Hill for arbitration. In the result, Mr. Hill found that no money was due to the Contractor, but that he owed the Corporation £1432, which he was ordered to pay, with costs, except those in the action.

Coming to the technical matters connected with water supply which have engaged attention during the year, the two meetings of the Association of Water Engineers claim first attention. At the summer meeting, held in Birmingham in June, under the presidency of Mr. H. E. Stilgoe, the members received a hearty welcome from the Lord Mayor, who congratulated them on having as their new President the worthy City Engineer. In his Inaugural Address, the President reviewed the past year's work of the Association, which had shown satisfactory progress, and then passed on to refer to some early examples of water-works and to deal with the allocation and protection of sources of supply. This led to some interesting remarks on the chalk area around Dover, from which town the President went to Birmingham, and on the question of waste. The papers submitted were upon the subjects of wells and boreholes and the design and construction of impounding reservoirs, by Mr. H. Ashton Hill and Mr. William Watts respectively; while Mr. R. H. Wynne-Roberts gave an interesting history and description of the Cape Town Water-Works. Visits were paid to the Elan Valley and Frankley works of the Corporation, as well as to the works of the South Staffordshire Water Company, descriptive pamphlets in connection with which had been specially prepared by Mr. E. Antony Lees, the Secretary of the Birmingham Water Department, and Mr. H. Ashton Hill, the Engineer of the Water Company, who had arranged the shorter trip for those who were unable to go to the Elan Valley. The social functions consisted of a reception by the Lord Mayor and Lady Mayoress at the Council House and the annual dinner at the Grand Hotel. At the winter meeting, held in London on the 11th and 12th inst., the chief feature of the first day's proceedings was a valuable lecture by Dr. Hugh R. Mill, President of the Royal Meteorological

Society, and Director of the British Rainfall Organization, on the "Measurement of Rainfall." An important discussion on the "Registration of Plumbers as Affecting Water "Authorities" occupied a large portion of the time of the members on the morning of the second day. Two papers were submitted—one dealing with the water supply of Hythe, by Mr. Christopher Jones; and the other furnishing a short account of a water-borne outbreak of typhoid fever at Malvern, by Professor W. R. Smith, M.D., F.R.S.E. The President made the very gratifying announcement that the Council had decided to offer three premiums for papers—one of the value of £10, and the other two of £5 each; and it transpired that the first prize was offered by Mr. Stilgoe himself. Mr. Robert Askwith, of the Weardale and Consett Water Company, was elected President for next year; and he offered the Association a hearty welcome to Durham for their summer meeting. The German Association of Gas and Water Engineers had, as usual, a very instructive annual meeting, which took place in June in Berlin. Herr H. Eggert gave an account of the development and present position of the water supply of the city; and papers were read on the hygienic valuation of water, on the physico-chemical aspect of impounding water, and on artesian well supplies in the North German plain. Two highly interesting reports were presented by Committees of the Association dealing with water statistics and the operation of water-works. It was decided to amalgamate the two Committees, and a grant of 5000 marks (£250) was voted for the work of the current year. Some other matters of technical interest worthy of passing reference are a lecture delivered early in the year by Professor Barrett, of Dublin, on "Dowsing"—a subject with which his name is associated in connection with investigations by the Society for Psychical Research; a paper read by Mr. G. H. Hughes, before the Junior Institution of Engineers, entitled "The "Filtration and Purification of Water;" papers on the bacteriology and the microscopical examination of water, submitted by Dr. S. Rideal and Mr. W. J. Dibdin in connection with the Municipal and Public Health Exhibition at the Agricultural Hall; and a paper upon the "Cardiff "Corporation Water-Works," by Mr. C. H. Priestley, the Corporation Water Engineer, to the Engineering Section of the Royal Sanitary Institute, on the occasion of their congress in that town. In the spring, the Croydon County Council had before them a proposal to adopt the ozone system of water purification; and later in the year demonstrations were held in London of the Siegwart system of making pipes of reinforced concrete. With respect to the literature of water supply, mention should be made of the publication of an interesting volume by Mr. William Coles-Finch, the Resident Engineer of the Brompton, Chatham, Gillingham, and Rochester Water Company, on "Water: Its Origin and Use,"* and of two valuable reports by Dr. A. C. Houston, the Director of Water Examinations to the Metropolitan Water Board, giving the results of his research work on the London Water Supply. At the meeting of the Institution of Mechanical Engineers in October, the Council awarded the first "Water Arbitration Prize," of the value of £30, to Mr. John Don, of Maybole, one of the associate members, for the best paper submitted on the "Filtration "and Purification of Water for Public Supply," the subject selected by the Council for the competition.

The general events of the year have not been of a nature to call for extended notice. Early in January, a scheme of water supply for Bungay—brought forward by Messrs. Preston and Perryn, the promoters of various gas and water undertakings, who proposed to start water-works without first obtaining statutory powers—was not sanctioned by the Local Authorities concerned, who considered that the possession of these powers, under either an Act of Parliament or a Provisional Order, was a condition precedent to the establishment of water-works in the district. The ineffectual efforts of one of the above-named gentlemen to capture the water supply of Holsworthy have already been noticed. The Stourbridge Water Company applied to the Board of Trade for power to extend their limits; but the Board would not consent to the inclusion of Broome and Belbroughton. They, however, gave the Company permission to raise £7500 of additional capital. Negotiations had been in progress for the acquisition of the undertaking by certain Local Authorities, and a satisfactory purchase clause was agreed upon. The transfer was in due course sanctioned by the shareholders, and authority will be sought next session for the constitution of a Joint Water Board to carry on the undertaking. Overtures were made for the purchase of the Slough Water-Works by the Urban District Council; but the parties failed to come to terms. The attempt is, however, to be renewed in the next session. The Crewkerne Urban District Council desired to purchase the water-works; but the Local Government Board would not sanction the raising of a loan for the purpose, as they considered the price (£15,500) much too high. Under the terms of an arbitration, the Criccieth Urban District Council have acquired the undertaking of the Water Company for £5649. The Devonport Corporation had submitted to them in June the results of their first complete year's working of the water undertaking. The Barnstaple Water Company held their jubilee meeting in August. In the course of some proceedings before the Police and Sanitary Committee of the House of Commons, the Finchley Urban District Council tried to get power for their Fire Brigade Superintendent to open the water-main valves of the Barnet District Gas and Water Company in case of fire; but the Committee would not grant it. It is gratifying to be able to record that the year has passed without any catastrophe occurring in connection with water supply undertakings. Unfortunately, two of the employees of the Bexhill Water and Gas Company lost their lives in a well; the Bradford water reservoirs on Barden Moor were much damaged by a cloud-burst which took place at the beginning of June over a portion of Wharfedale; and there were several bursts of mains, which necessarily caused inconvenience. But the "chapter of accidents" is happily not a long one. Trouble arising from shortage of water was experienced at Derby, Lisbon, and Vienna; cases of lead poisoning gave rise to investigations at Dewsbury; and two Local Government Board Inspectors held an inquiry in regard to the water supply of Cambridge, which it was thought was liable to pollution. In the report which has been recently presented by the Inspectors, they advise the abandonment of the water derived from the lower chalk. Towards the end of the year, the movement which has been on foot for some time to secure efficient work in connection with water and sanitary house fittings took definite shape in the constitution of a General Council for the National Registration of Plumbers; and the subject was discussed at some length at the recent meeting of the Association of Water Engineers, as reported in the "JOURNAL" last week. Simultaneously with the announcement of the formation of this Council came a notification of the registration of an "unlimited" Company, under the title of "The Incorporated Joint Com-"mittee on Water Regulations," consisting of 100 members, each liable for £1 in the event of winding-up, and having offices in London. The two events just recorded should result in raising the quality of plumbers' work.

Before bringing this retrospect to a close, a few personal matters which have occurred during the year call for brief notice. Among the various official changes which have taken place, probably the most important was the removal of Mr. F. J. Bancroft from Hull to Barnet, and the appointment of Mr. C. B. Newton, formerly of Carlisle, as his successor. Mr. Harry S. Best, of the Plymouth Water Department, obtained an engagement under the Rangoon Municipality; Mr. C. Diggory was appointed Secretary of the Corwen Water Company in succession to Mr. J. Williams, resigned; Mr. F. J. Dixon, the Water Engineer to the Harrogate Corporation, was selected to fill a similar position under the Stalybridge, Ashton, and Dukinfield Water Board; Mr. Hugh Hughes was retained by the Criccieth Town Council to manage their newly-acquired water-works; Mr. Frank James retired from the Chairmanship of the South Staffordshire Water Company, after holding it for thirty-four years; Mr. William Matthews resigned the position of Water Engineer to the Southampton Corporation, and commenced practice on his own account; Mr. Lewis Mitchell was appointed Joint Water Engineer with Mr. R. H. Swindlehurst of the Bolton Corporation; Mr. William Morris, after fifty years' association with the water supply of the Kent district, retired from the service of the Metropolitan Water Board; and Mr. J. W. Smith was selected to fill the position of Resident Engineer to the Bury and District Joint Water Board. As mentioned when dealing with the affairs of the Metropolitan Water Board, Mr. Arthur Newton was appointed Comptroller, in succession to the late Mr. F. E. Harris. In the course of the year, presentations were made to Sir Hugh Bell, whose name is known to many of our readers from his connection with the chairmanship of the

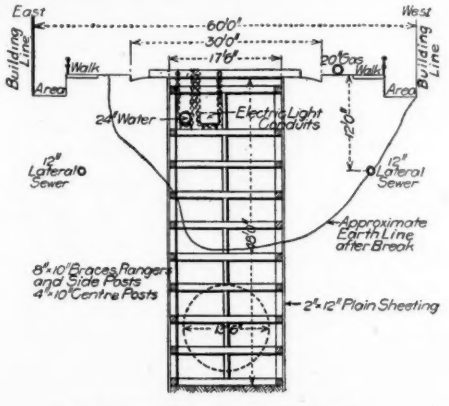
* A review of this work appears on p. 893.

Tees Valley Water Board; to Alderman Gainsford, on his resignation of the chairmanship of the Water Committee of the Sheffield Corporation; to Mr. J. Pile, formerly Resident Engineer at the West Molesey station of the Metropolitan Water Board; and to Mr. J. Wright, who was for forty-four years connected with the water supply of South London, on his retirement from the Board's service.

During the year we have unhappily had to record the removal by death of several gentlemen connected with water undertakings—viz., Alderman Day, the Auditor, and Mr. H. W. Tyrwhitt Drake, the Chairman, of the Maidstone Water Company; Mr. Charles Gott, a well-known engineer of Bradford; Alderman David Jones, the Chairman of the Water Committee of the Cardiff Corporation; Mr. L. L. Macassey, the Consulting Engineer to the Belfast Water Commissioners; Mr. John Mallinson, the Surveyor and Engineer to the Skipton Urban District Council; Alderman Edward Lawley Parker, the Chairman of the Water Committee of the Birmingham Corporation; Sir Alfred de Bock Porter, who was a member of the Metropolitan Water Commission of 1897; Mr. E. J. Purnell, the Consulting Water Engineer to the Coventry Corporation; Alderman F. Sudbury, the Chairman of the Ilkeston and Heanor Water Board; Herr H. Thiem, the well-known Water-Works Engineer of Leipzig; Alderman Wade, the Chairman of the Water Committee of the Halifax Corporation; Mr. Samuel Waite, who was for forty years associated with the Lambeth Water-Works; Mr. Henry Wells, a Director of the Aldershot Gas and Water Company, and the Chairman of the Urban District Council; Mr. William Wearing, who had for nearly forty years been in the service of the Fylde Water Board, for nine years as their Engineer; Mr. Isaac Williams, the Chairman of the Water Committee of the Skipton Urban District Council; and Mr. William Wilson, who was for many years a Director of the Monte Video Water-Works Company.

THE BROOKLYN GAS EXPLOSION (?).

In the "Journal" for the 24th ult. (p. 574), a few particulars, based on telegraphic messages in the London papers, were given of a shocking accident which occurred in Gold Street, Brooklyn, a few days previously, as the result of the walls of a sewer excavation giving way, and causing the fracture of gas and water mains, followed by explosion, fire, and flooding, and, unfortunately, considerable loss of life. As was mentioned at the time, the reports which reached London varied in details, and consequently it was difficult to ascertain the actual facts. The current number of "Engineering Record," however, contains what appears to be an authentic account of the catastrophe, accompanied by a diagram showing a section of the trench. We reproduce it and the following explanatory remarks.



Sewer Trench in Gold Street, Brooklyn.

The relief sewer, in Gold Street, Brooklyn, is 13 ft. 6 in. inside diameter, built of concrete, with a brick-lined invert, located in places 45 to 46 feet below the grade of the street. The work had been in progress for about a year without serious mishap; but on the 20th of November, while the final closure section, 200 feet long, was nearing completion, a section of the trench caved-in, burying a number of workmen and pedestrians. The trench at this point was about 48 feet deep and 17 ft. 6 in. wide, and was sheeted with plain 2-inch planking against 8-in. by 10-in. rangers and braces. There were ten sets of the latter; the top one being about 18 inches below the street level, and the bottom one on the floor of the trench, making the vertical spacing of the other sets about 5 feet. The braces were from 7 to 8 feet apart in plan. The rangers were posted with 8-in. by 10-in. posts on the same centres as the braces on both sides; and at the centre of the trench with 4-in. by 10-in. posts. The sheeting was driven 1 foot below the sub-grade. The street is 60 feet wide between the houses, and 30 feet between the kerbs. The underlying material consisted mostly of sand and gravel, with some loam and hardpan, and a layer of coarse sand about 8 feet above the bottom of the trench. The sub-surface structures were a 20-inch gas-main, a 24-inch water-main, electric wire ducts bedded in concrete, and a vitrified pipe sewer line.

Before commencing work on the relief sewer, a 12-inch lateral was laid in a trench from 12 to 14 feet deep under each sidewalk. This was done last winter, and the sheeting was left in place when the trench was back-filled. The water-main and the electric wire ducts were suspended from 12-inch square timbers spanning the trench and resting on the street surface. Except for blocking against the second brace from the top, in order to steady them, the water-pipe and the ducts were supported entirely independently of the sheeting and bracing. The manholes for the ducts were carried on similar timbers, which were knee-braced against the bracing below. The gas-main was placed temporarily on the edge of the sidewalk on the west side of the street. The sheeting and bracing were done as the excavation progressed. When the placing of concrete began, the lowest set of braces and rangers was removed, the sub-drain put in, and a 6-inch grillage of 4-inch and 2-inch planking was laid. Above this was a 12-inch concrete foundation. At this stage the next set of braces and rangers was taken out, and the concrete placed up to the springing line. The succeeding step consisted in the removal of the next set (or two sets if necessary), and placing and centring the collapsible steel forms on which the arch was cast; the load on the sheeting being carried across by knee-bracing to the bracing above.

When the accident occurred, all three stages of the work existed in the trench. The sheeting and bracing were apparently in good condition the day before; and though the representatives of the Brooklyn Edison Company, the Brooklyn Union Gas Company, and the Water Department, in addition to the Bureau of Sewers, had been on the work attending to their structures, no complaints were made, and no difficulties were experienced. The accident, so far as can be learnt, came without warning; the street slipping into the trench from both sides, as shown approximately in the diagram. Those in charge of the work are unable to assign any cause for the accident. The building foundations on both sides of the street do not show any signs of failure, as might have been the case had the earth been settling towards the trench for some time. The comparatively green trenches under each sidewalk for the 12-inch lateral sewers laid last winter have been suspected as a contributing cause by some who have examined the site. An explosion is reported to have occurred at the time of the failure; but whether it came immediately before or after the slip is not known. The breaking of the 24-inch water-main caused the rapid flooding of the trench, and made certain the death of those caught in the slip. Eight of the contractors' men and the City Inspector are unaccounted for, and are believed to be under the *débris*, as well as two or three children who were playing in the street at the time. A number of workmen escaped by walking through the finished sewer to the bulkhead at the East River, 1100 feet distant. The excavation of the caved-in material and the rebuilding of the trench have been going on night and day since the accident occurred. The contractors first threw long piles across the *débris* at right angles to the sewer line, and placed upon them two sets of 12-inch square rangers and braces. Sheeting was then nailed on the back, and the excavated material was thrown behind it. Succeeding sets and sheeting are being placed in the usual manner as the excavation proceeds.

PERSONAL.

Mr. J. Purves, of Leeds, has been appointed Manager of the Ayr Gas Company, Limited, in room of Mr. W. Smith, who has resigned on account of ill-health.

Mr. William Cash, F.C.A., has been appointed an Auditor of the British Gaslight Company, Limited, to fill the vacancy caused by the death of Mr. Edward Yardley.

The Belfast Gas Committee held a special meeting last Tuesday for the purpose of selecting an Engineering Assistant in connection with the proposed extension of the gas-works. There were some twenty applicants for the position; and out of these the Committee at their previous meeting selected four who were requested to attend the special meeting. After having interviewed these candidates, the Committee resolved that Mr. John W. Murray, of the Glasgow Corporation Gas Department, be appointed to the position, subject to the approval of the Council. Mr. Murray has had over 25 years' experience as a Gas and Water Engineer and has arranged the plans, and superintended the erection, of gas-works.

The eldest son of the late Mr. Henry A. Willey died on the 18th inst., at his mother's residence, Pennsylvania Park, Exeter, aged 11.

Mr. Henry Hack is leaving England next week for a three months' trip in South Africa—his first extended holiday since his retirement from the Gas Engineership at Birmingham.

INVESTIGATION OF A SETTING OF HORIZONTAL CHAMBERS AT ROTTERDAM.

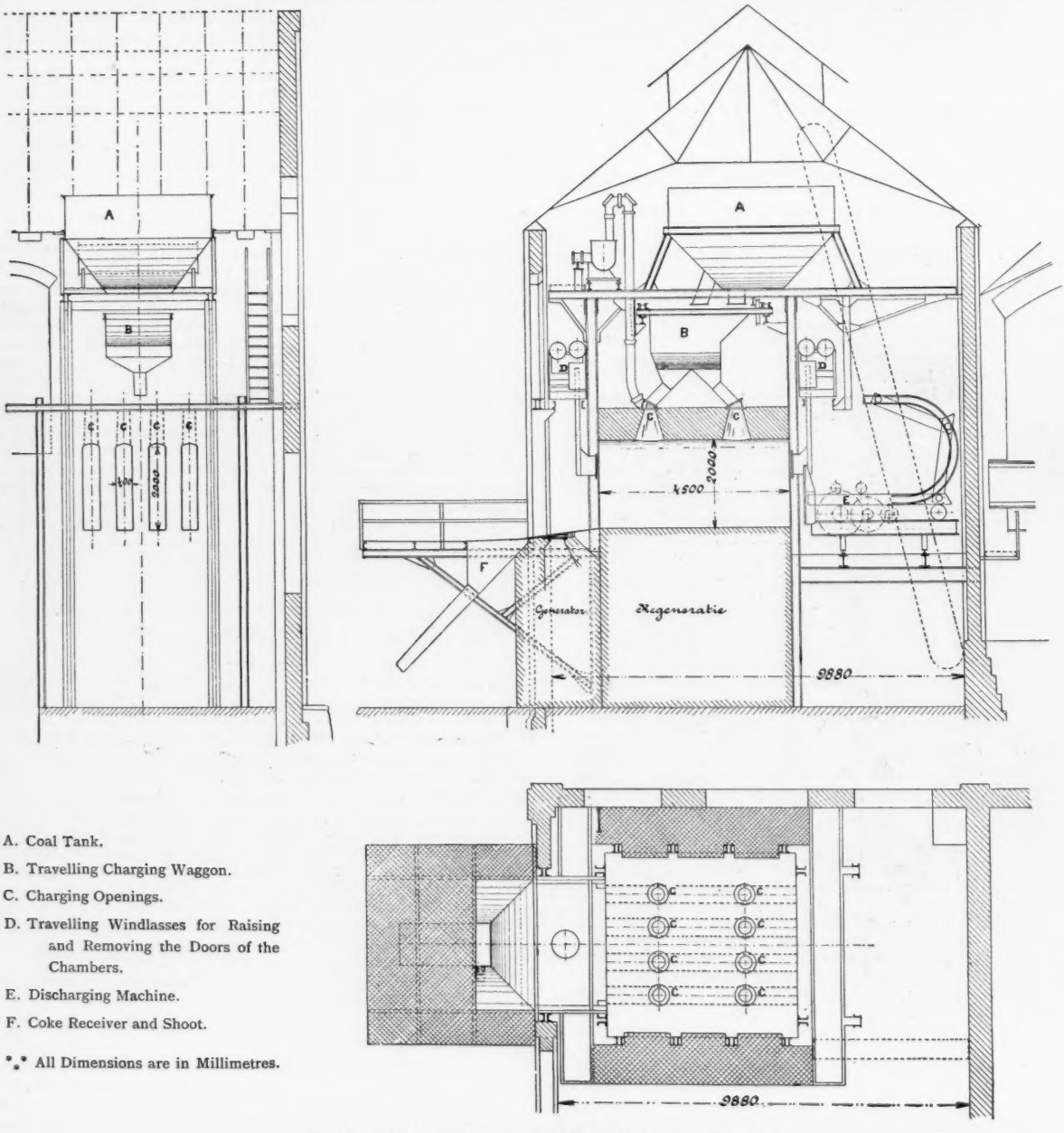
THE following is an abstract-translation of a communication by Heer M. Sissingh, of Rotterdam, to the last number to hand of "Het Gas," giving an account of a trial run of a new setting of horizontal chamber ovens at the Oost-Zeedijk (or Eastern) Gas-Works in that city.

The setting was erected for the purpose of studying the question of the carbonization of coal in horizontal chambers resembling the ovens used in coke-works. The construction was substantially on the lines of a modern coke-oven; but having regard to the fact that gas was to be the chief product instead of coke, it was arranged that the setting should be heated by means of coke instead of by gas as in coke-works. Having regard also to the quality of the coke not being so important a matter as in coke-works, it was decided not to provide for the washing of the coal for carbonization, and to distil the charge for a shorter time than was customary with coke-ovens. The space available for the setting was somewhat cramped; consequently, working at it was more hampered than it would have been in a more open position.

The setting was designed and constructed by the Dortmund firm of Aug. Klönne. It contained four chambers, each 14 ft. 9 in. in length, 6 ft. 6 in. high, and 1 ft. 4 in. in average width. Each chamber was charged once in twenty-four hours through two openings with lids in the roof. The discharging was effected by a horizontal expelling machine, which could be brought in front of each chamber. It pushed out the block of coke by means of a ram. Each chamber was provided with doors at each end for the discharge of the coke. The broken coal was raised by an elevator to a tank above the setting. From the tank, charging trolleys, travelling horizontally, were filled with it. These trolleys were provided with two pipes or shoots, which could be brought one into each of the charging openings in the roof of a retort, so that charging through both at the same time took place. Two conical heaps of coal are thus formed below the charging openings; and these are levelled by means of rakes introduced through openings, with lids, in the upper part of the doors of the chamber. The chamber was filled so that only a small space was left above the charge. The doors of the chambers could be removed independently by means of a hoisting arrangement, and, when in position, were made tight against their frame or seating by means of three Morton self-sealing devices.

The ram by which the coke was expelled from the retort consisted substantially of a push-bar with a ram-head. Owing to the cramped position, the push-bar was built up of a number of hinged parts, so that it could be rolled up in the form of a bow. It was driven in and out by means of an electric motor, which also served to move the trolley on which the discharger was mounted to and fro in front of the chambers, so as to bring it in position before either one as required. The evolved gas escaped through an ascension pipe, which was attached to one of the two charging openings. The pipe dipped into a hydraulic main or seal-tank, and a water seal was maintained there throughout the trials.

The evolution of gas begins at a moderate rate, and increases gradually until it reaches its maximum at about fifteen hours, after which it gradually falls off. The composition of the gas agrees nearly with that of coal gas of good quality. The mass of coke shrinks in the course of carbonization; so that when the time comes for expelling the charge from the chamber, there is a



A. Coal Tank.

B. Travelling Charging Waggon.

C. Charging Openings.

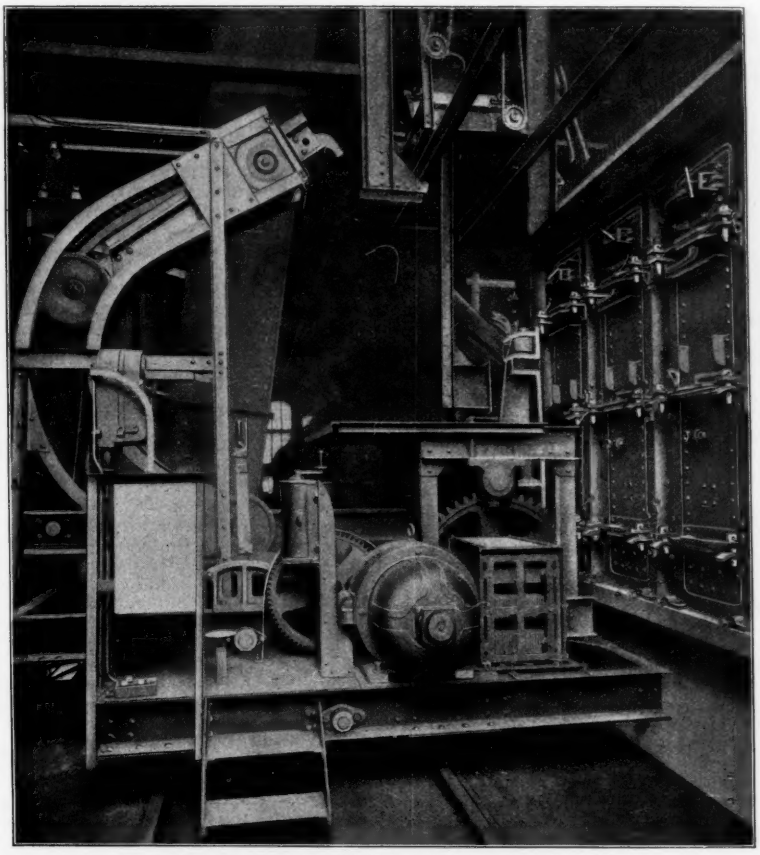
D. Travelling Windlasses for Raising and Removing the Doors of the Chambers.

E. Discharging Machine.

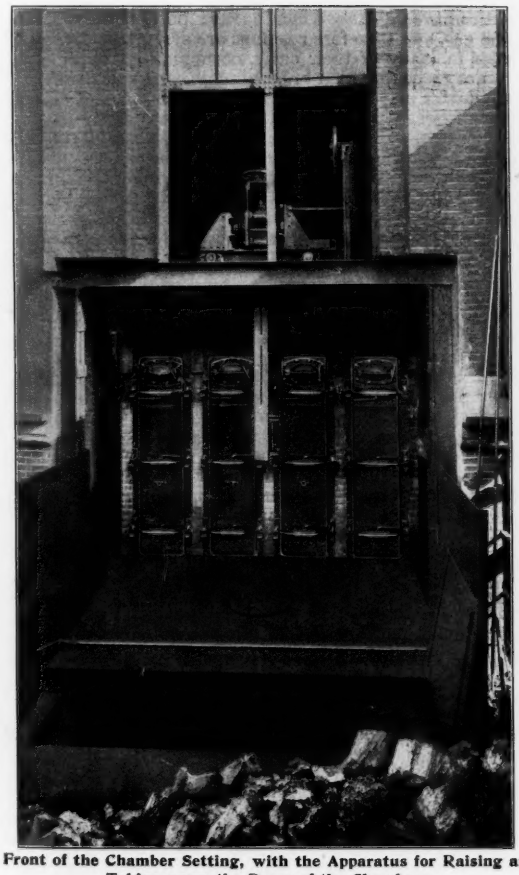
F. Coke Receiver and Shoot.

*** All Dimensions are in Millimetres.

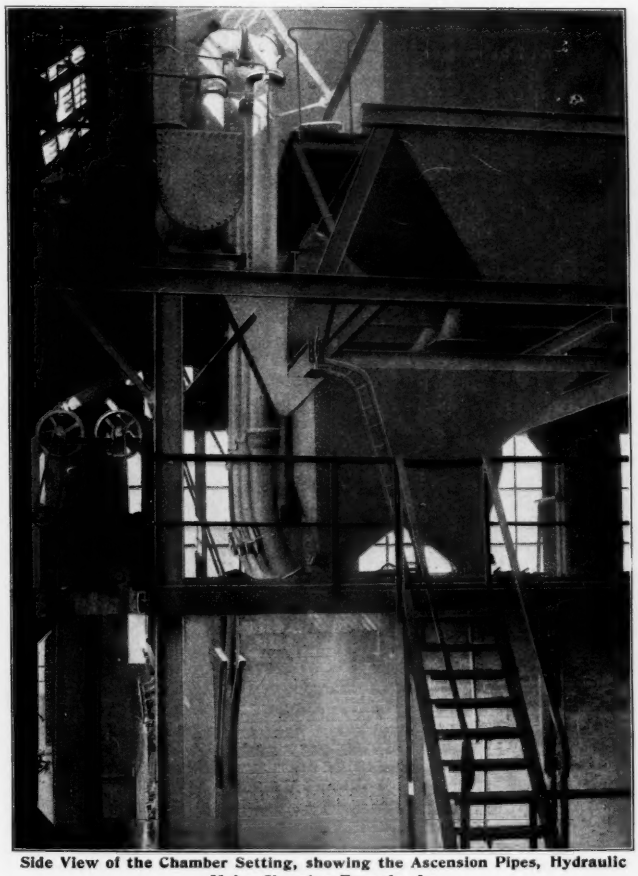
Section of Horizontal Chambers at the Rotterdam Gas-Works.



Coke Discharger with Electric Motor at the Back of the Setting.



Front of the Chamber Setting, with the Apparatus for Raising and Taking away the Doors of the Chambers.



Side View of the Chamber Setting, showing the Ascension Pipes, Hydraulic Main, Charging Funnels, &c.

wide gap between the block of coke and the walls of the chamber. Consequently, it can be expelled without difficulty. The block of coke is expelled as a large cake; but vertically through its longer axis there is a seam, at which it splits into two as it comes out of the chamber. It is denser and harder than ordinary gas coke, but is easily broken into comparatively small pieces. It is also more difficult to ignite; but it lasts longer, and affords a hotter fire, than ordinary gas coke. The tar is a thin liquid containing very little free carbon; but its composition has not yet been exhaustively investigated.

In order to ascertain the results obtainable with the chambers, and to determine whether the guarantee given by the constructing firm was fulfilled, a trial run of three days' duration was carried out. It commenced at 6 a.m. on Oct. 7, and ended at the same hour on Oct. 10. The coal used was from the "Hugo" pit in the Ruhr coalfield. An average sample gave the following results when tested in a platinum crucible according to Van Eindhoven's method :—

Moisture	2·45 per cent.
Volatile matter	28·32 ,, ,,
Carbon	59·83 ,, ,,
Ash	9 40 ,, ,,

In the three days, 33·004 metric tons of coal were carbonized in the four chambers. There were obtained from this quantity of coal 400,056 cubic feet of gas measured at 60° Fahr. and 30 inches barometer, or an average of 133,350 cubic feet per twenty-four hours, and of 12,314 cubic feet per English ton. The quality of the gas was ascertained by means of determinations, made every hour, of its calorific power. Taking into account the hourly fluctuations of the make of gas, the series of results of the calorific power tests were applied for calculating the mean calorific power of the gas. This was found to be 622·6 B.Th.U. gross, and 558·5 B.Th.U. net, per cubic foot.

The coke used in heating the chambers was found by analysis to consist of—

Water	3·57 per cent.
Ash	13·80 ,, ,,
Carbon	82·63 ,, ,,

The consumption was equivalent to a weight of dry coke equal to 17 per cent. of the weight of coal carbonized, or of dry and ash-free coke equal to 14·5 per cent. of that weight.

The tar produced amounted to 13 gallons per ton of coal. It contained 2·54 per cent. of free carbon, and had a specific gravity of 1·09. The yield of ammonia was equivalent to 0·334 per cent. of the weight of coal carbonized, which is equivalent to a yield of 1·297 per cent. of ammonium sulphate, or 29·05 lbs. per ton. It was not possible to determine the yield of coke during the trial; but some days later, when the same coal was being carbonized, the coke and breeze produced were weighed. The yield was 76·7 per cent. of the weight of coal carbonized; but as this coke contained 5·325 per cent. of water, the yield of dry coke would have been 72·6 per cent.

The temperature within the chambers close to the walls was 950° C. during the trials, and in the combustion passages between the chambers 1210° C. The temperature was uniform, in that the sight holes in the upper and lower part and at the back and front of the chamber showed the same uniform colour. There was no appreciable formation of scurf, or deposition of soot in the ascension pipes, nor was thick tar produced. Since the setting started to work on Aug. 8 to the date of writing, Nov. 4, it has not been necessary to remove scurf from the chambers; there have been no stopped ascension pipes; and the tar has always been a thin liquid.

By the courtesy of Heer P. Bolsius, we are able to reproduce from our Dutch contemporary, "Het Gas," the line diagrams of the chambers. The three views of the plant are taken from photographs lent by the firm of Aug. Klönne, of Dortmund.

OBITUARY.

It is with sincere regret that we have to record the death, on Monday last week, of Mrs. Amélie Andrews, the widow of the late Mr. Thornton Andrews, of Swansea. The sad event occurred exactly a week after the severe bereavement she had sustained by the loss of her husband.

After a long and distressing illness, Mrs. Glover Clark died last Tuesday, at Stirling House, Clapton Common, in her 52nd year. Much sympathy is felt with Mr. Glover Clark (London representative of Messrs. Thomas Glover and Co.) and his family in their bereavement. Representatives of the Evening Star Lodge, of which Mr. Glover Clark is W.M. this year, attended the funeral on Thursday at New Southgate Cemetery.

The last number of the "Journal des Usines à Gaz" contains the announcement of the death of M. Charles Foucart, Chairman of the Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz, and a Past-President of the Société Technique. Deceased was born on Oct. 21, 1825, and quite early in life entered the gas profession under his father in the gas-works at St. Mandé. When these were taken over by the old Paris Gas Company, he entered their service as head of the commercial branch, at the same time working with his father, with whom he constructed the works at Auxerre. He subsequently acquired the works at Laon, and obtained concessions for the supply of gas to Poissy, Vervins, and Melun, for which he constructed the works. He was a stout defender of the rights of gas companies, and a firm upholder of conventions. He was one of the founders of the Société Technique, was President in 1882, and never ceased to take an interest in it. The funeral was numerously attended by members of the Society as well as of the companion organization, the Syndicat Professionel. In the unavoidable absence of M. Godinet, the President of the Société Technique, it devolved upon the Vice-President (M. Marquisan) to give a few particulars of the life-work of the deceased.

GAS CALORIMETRY.

In the general notice of the proceedings at the third annual meeting of the American Gas Institute which appeared in the "Journal" for the 10th ult., it was mentioned that the opening business on the second day was the reading of the report of the Sub-Committee on Calorimetry, illustrated by lantern slides, and accompanied by explanatory remarks by Mr. J. B. Klumpp, a member of the Sub-Committee—his colleagues being Mr. R. B. Brown (Chairman) and Mr. C. F. Burgess. The President (Dr. A. C. Humphreys, the Principal of the Stevens Institute of Technology) expressed his unqualified approval of the report, from which we give some extracts. It is divided into six chapters: (1) Gas Calorimetry. (2) Calorific Value as Related to Heat Utilization. (3) Calorimeters. (4) Tests. (5) Specifications and Recommendations. (6) Single Standard of Gas Valuation.

Gas Calorimetry.

Ten years ago, gas calorimetry in the United States was practically unknown—that is, calorimetry as a general practice in a commercial business; and it has only been recently that a few of the larger gas undertakings have been making the calorific value of the gas a regular test at the works. Probably half-a-dozen of our larger companies have been making readings systematically or experimentally for some years; but it is only since the State and civic authorities have enacted measures governing the heating value of gas delivered, that the calorimeter has been adopted as an instrument to be used daily in our works, and a systematic record made of the heating value of the gas manufactured. In Germany the gas-calorimeter has been in more general use, as the authorities and companies there have appreciated the importance of the heating quality of the gas. The English authorities and supplying companies have demanded spasmodically that the gas should be of a certain heating value; but readings have not universally been made in England, though the heating value has been recorded for some time by the larger companies.

The candle power of gas supplied in both Germany and England has been generally lower than in the United States, owing to the fact that the greater percentage of the gas manufactured is coal gas. The tendency has been in England during the last four or five years to reduce gradually the illuminating value, as it is known that the heating value is not proportionately lowered. So, while reports of the heating value have not been generally demanded, many of the larger companies have been making and recording calorific readings. In Germany, in some instances, the authorities have demanded continuous reports of the calorific value of the gas, and therefore readings are systematically made and recorded in many of their cities, occupying an importance equal to, if not exceeding, that of the illuminating value.

Gas calorimetry may be defined as a process of determining the quantity of heat developed by the complete combustion of a unit volume of gas. The common and most successful method of accomplishing this is through the use of an instrument known as the "calorimeter," its auxiliary meters, thermometers, regulators, scales, and weighing-tanks. An exact quantity of gas can be burned under prescribed conditions, and the heat developed in the combustion absorbed by a known weight of water passing through the instrument. It is possible, knowing the weight of the water passed and the rise in temperature, to calculate the entire quantity of heat absorbed by the water. This type of instrument is so much the simplest in design and application, that your Committee adhered to it in their experimental and test work.

The British thermal unit (B.Th.U.) is the quantity of heat required to raise 1 lb. of water at its maximum density 1° Fahr.; the maximum density being at a temperature of 39·1° Fahr. The amount of heat absorbed by water in being raised 1° at normal operating temperatures—say, from 60° to 90°—is, however, practically the same as when it is at its maximum density; the error being, at 90°, only 0·016 per cent., and less at lower temperatures. Therefore, no correction is considered necessary in our operation. The discrepancy would account for a difference of only 0·096 of a unit in a gas of 600 B.Th.U. Based on the fact that all gas in America is sold by the cubic foot, and that the British thermal unit has been in general use as expressing the unit of heat, your Committee believe it is proper to recommend the use of the Fahrenheit thermometer, the cubic foot, and pound; the results being expressed, by direct multiplication, in British thermal units.

The accuracy of operating depends upon several factors. The instrument should be installed in a well-ventilated, light room, free from draughts and vibration, and of normal temperature. The gas should be measured at the temperature of the atmosphere, and the exhaust products should leave the calorimeter as nearly as practicable at the same temperature. With the temperature of gas, inlet water, air, and exhaust products alike, there will be no reasons for making corrections for the sensible heat absorbed or lost. The temperature of the water should be practically that of the operating-room, and should be uniform. The accuracy of the instrument also depends upon the constancy of operation—that is, the rate of flow of gas should be constant, the heat transmitted should be uniform, and with an unvarying temperature of the inlet water there should be no variation in that of the outlet water.

Calorific Value as Related to Heat Utilization.

By this we mean the heating value of the gas as determined by the calorimeter, and the available heat in the gas applicable

for various uses in the arts. Many bad misunderstandings have arisen from the use of the words "gross" and "net," as applied to heating values. The "gross" heating value is that which is obtained by the calorimeter when the gas, air, and exhaust products from the calorimeter are at the same temperature. This condition strikes a thermal balance for the calorimeter, and the heat absorbed by the water passing through the instrument is all the heat developed by the combustion of the gas. This result, under normal conditions, is not exact, as the entrained moisture in the air and gas, and that found in the products of combustion, do not balance; but the errors in absorbed heat are slight. The calorific value as determined by the calorimeter is the "gross" or true heating value developed by the combustion of the gas; the "net" heating value, so called, is the "gross" heating value less the latent and sensible heat of the water vapours condensed in the calorimeter. Where there is a large percentage of free or combined hydrogen, this condensation is greater; and in certain gases the difference between "gross" and "net" may be as high as 10 per cent. In other commercial gases, it may be as low as from 3 to 5 per cent. But this latent heat is not lost until the products of combustion leave the apparatus. Under ordinary conditions, this might be 130° to 150°; while under others it would be much higher.

If the latent heat and sensible heat of the condensed water from the products of combustion are deducted, there is just as much reason for deducting the sensible heat of the uncondensed portion of the products of combustion, since it is necessarily lost at the same time; and if the temperature of the exhaust products leaving the appliance is very high, this sensible heat may be several times that deducted in obtaining the so-called "net" value. In other words, there would be a different true "net" value for each change in conditions of the utilization of the gas, and none of them determinable by direct test by a calorimeter or any other known instrument. Therefore, the Committee are of the opinion that the heating value of a gas should be expressed only in that which is determinable as the "gross" or total heating value—the value of the gas as given by the calorimeter. Gas has become a competitive fuel in many of our industries. All other fuels are rated by their total heating value. Why not gas?

Calorimeters.

The only calorimeters considered by your Committee were of the Junkers or water-heater type, measuring the gas and determining the calorific power by transferring the heat developed to a known quantity of water, and determining the rise in temperature of the water. This we think is the only practical type of commercial calorimeter on the market; and your Committee disapprove of the adoption for commercial practice of any instrument which determines the heating value by raising the temperature of metals, or that records the heating value by measuring the density of liquids, or by which the heating value is deduced from the quantity of air required for combustion. We also disapprove of the use of calorimeters which do not measure the total heating value of the gas.

The Junkers gas-calorimeter is probably the best-known available instrument. It has been extensively used in the gas-works of Germany and England, and to-day is employed in the United States by the gas industry and by users of producer and blast-furnace gas. Gas-engine manufacturers have depended almost entirely on this instrument for observations to check the guarantees of their engine economies. It was probably the first and most accurate calorimeter to be put into general service; and it deserves entirely the credit it has received. An improvement may be made by having the water inlet and outlet on the same level and adjacent, so that the thermometers may be more conveniently observed. The construction of the meter is such that it is impossible to adjust the water level. The capacity of the calorimeter is such that it may be used for testing either low or high heating value gas.

The Boys calorimeter, designed by Mr. C. Vernon Boys, of London, is an instrument which has been adopted by the London Gas Referees for determining the heating value of London gas. This instrument is of limited capacity, and, while it may be made to give very accurate readings with some gases, it is inconvenient in operation, as its construction necessitates taking it apart to light or extinguish the burner. The flame adopted is of the illuminating style, and, under certain conditions, with rich gas, is apt to smoke and deposit carbon on the interior of the calorimeter.

The Simmance-Abady calorimeter is an English instrument, and is little known in the United States. This instrument is mounted on a platform, which makes its use as a portable instrument inconvenient. There were several difficulties encountered in its manipulation that appeared like defects in the design of the instrument. The outlet water temperature was very difficult to control, and led us to believe that the average reading of the outlet thermometer did not record the average temperature of the outflowing water. The operating directions of this instrument also indicated that fractional revolutions of the drum of the meter should be taken in making observations. The instrument was not provided with a water outlet of constant head. The calorimeter was jacketed with wood, which was found by the Committee to be unsuitable, and not so satisfactory for accurate work as a polished metal jacket.

The Sargent was the only American calorimeter examined by the Committee. The first instrument tested was found faulty in design, and gave irregular readings. A second was submitted by the makers, which gave better comparative readings with the other calorimeters. It embodies arrangements intended to assist in making rapid and accurate observations. The principal point of difference in the Sargent calorimeter is in the adoption of the English units entirely, and of weighing the water instead of measuring it in glass graduates. The instrument is further provided with an automatic electric device that changes the water supply from one measuring vessel to another at fixed revolutions of the meter.

The tests made by your Committee consisted of readings at Philadelphia, further readings at the laboratories of the Milwaukee Gas Company, and, finally, of an extended series of readings in the laboratories of the University of Wisconsin, at which special equipment was provided for the purposes of this investigation. The calorimeters were erected and operated according to the instructions of the makers, so far as practicable. Changes from the prescribed methods were made only when it became evident that they would lead to better results with the given instrument. They were then operated to determine the capacity of each calorimeter for the absorption of heat. They were further checked to determine the effect of varying quantities of water being raised to different temperatures, and then checked to see what effect varying the quantity of air supplied to the burner of the calorimeter would have. Further tests were made to determine the actual efficiencies and the rate of combustion at which the maximum efficiency occurred. The purpose of the investigation was to secure information on which to base recommendations to the Institute as to calorimeters for general commercial practice; also to determine the accuracy and the efficiency of calorimeters in common use, and to formulate and prescribe rules and methods of operating.

All the apparatus was set up on a bench in a room which could be kept free from draughts. Each calorimeter had its own water and gas connections.

In order to operate the calorimeters under more nearly uniform conditions, some changes were made from the arrangement of apparatus provided by the manufacturers. All meters registered 0·1 cubic foot per revolution. Water was caught in copper tubs and weighed on scales sensitive to 0·5 gramme in 5 kilogrammes. Float pressure-regulators of the Junkers make were used on three instruments, and a similar regulator on the Simmance-Abady. All copper tubs were carefully counterbalanced against a lead weight. This was done with the inside of the bucket wet, so that no correction would be required during the tests. The tubs were filled with water, emptied, and then shaken in an inverted position for about five seconds.

All the tests were run in series, and tests of the same series number on different instruments were run at very nearly the same time. A new series was started with each new sample of gas. The series of tests as made extended consecutively from A to N. Series A to F inclusive were made with an idea of becoming more familiar with the operation of the several calorimeters, and to find out the effect of varying the gas, water, and air supply. Series G and H were made to determine the most efficient rate of combustion of gas in the several calorimeters, maintaining a constant water supply. With the gas used for these tests, it was found that for the Boys calorimeter a rate of combustion from $3\frac{1}{2}$ to $4\frac{1}{2}$ cubic feet per hour was the most advantageous; for the Sargent, about 5 feet; for the Simmance-Abady, 4 feet; and for the Junkers, 7 feet. Series I and P were run using these different rates of combustion, and comparative results were obtained.*

Specifications and Recommendations.

Your Committee recommend the adoption of a calorimeter of the water-heater type. In determining the calorific value of the gas, we recommend the adoption of English units; the measuring of the gas in cubic feet; and the correction of the volume of the gas to standard volume, as expressed when measured under a standard temperature of 60° Fahr. and a standard barometric pressure of 30 inches of mercury. We recommend taking all temperatures of air, gas, and water with Fahrenheit thermometers, and expressing the result in Fahrenheit degrees; weighing the water used with balances reading in pounds and hundredths of a pound; and expressing the result of all calorific determinations of gas in British thermal units (B.Th.U.), which is the natural product of a pound degree.

As not one of the calorimeter outfits supplied was entirely satisfactory, and as several improvements suggested themselves during the experiments, the Committee submitted a number of recommendations which they considered should be adopted to ensure the best results. On the subject of the calorimeter and the burner used, they said: The calorimeter should be designed to give a constant head of water on the apparatus. This head can be maintained by having a weir overflow on the inlet at some distance above the top of the calorimeter, and a weir overflow on the outlet. The rate of flow through the apparatus should be regulated by means of a cock on the inlet water. It was necessary, in the case of the Boys calorimeter, to use a screw-cock on the rubber tubing in order to get variations in the rate of flow. This was not used on this calorimeter except during a very low consumption of gas, as at a higher consumption the coil was not large enough to give an amount of water capable of reducing the temperature to the desired range.

* Details and diagrams of all the tests here referred to are given in an appendix to the report.—Ed.J.G.L.

A calorimeter should be so built that the water will circulate freely, and that there will be equal distribution of water throughout the apparatus. Baffle-plates should be so arranged that the water will be thoroughly mixed before coming in contact with the bulb of the outlet thermometer, thereby giving correct readings. The design should be such that air-pockets will not form in the water space. It was found in several tests that considerable variations in temperature arose from neglect in this particular. The calorimeter should be made of bright polished metal, air-jacketed in all parts. We found a reduction in heating value by one of the calorimeters on spilling water over the wooden jacket, due to evaporation of water from the jacket; and since the accidental wetting of the jacket is always liable to occur, we consider the use of an absorbent jacket a serious defect in design. There should be in the exhaust-gas flue a damper which can be easily adjusted, and which will not be moved by a slight jar. The calorimeter should be mounted on four legs, with a spread great enough to give a firm base, at a height sufficient to make it easy to put the burner in place. The thermometers should both be on the same level, so as to facilitate readings. This is a desirable feature of the Sargent calorimeter; and there is no reason why all the Junkers instruments made in the future should not conform to it. Openings for the thermometer corks should be large enough to take a No. 4 rubber stopper. The Boys calorimeter was provided with a burner with an illuminating flame; and while this was found satisfactory for small gas consumption, it was replaced with a bunsen flame, which was equally satisfactory under all the same conditions, and, in addition, had a wider range for the rate of flow. The burners provided with the other instruments tested were solely of the bunsen type, which is the one we recommend for general use. The burner should be a long-tube bunsen, having a spreader on the top, and an adjustable air-mixer which can be easily reached when the burner is in position in the calorimeter. The burner should be provided with a stop-cock to change the regulation, and it should be attached to the calorimeter in such a way that its position cannot be accidentally shifted, and so that the condition of the flame may be observed by the operator, either directly or by the means of a reflecting mirror.

The Committee's recommendations are followed by some critical remarks on the various calorimeters, based upon experience gained during the tests, and a few suggestions as to the selection of a calorimeter. After these come the Committee's

Instructions for Operating a Calorimeter.

The calorimeter should be set up in a quiet, light, and well-ventilated room, which is free from draughts, and in which the temperature can be maintained constant between 60° and 80° Fahr. The room should be provided with a bench and sink, and with a good supply of running water. It is advisable to have a large shallow open tank suspended from the ceiling, from which the water supply can be taken. This tank should be large enough to supply the calorimeter for a series of a dozen or more tests. By having the tank shallow, the water is brought more quickly to the temperature of the room. In order to compensate for the difference in head as the tank is emptied, it is advisable to have a weir overflow on the outlet. If only a single test is desired, gas may be taken from the house piping; but if the average value is required, a small holder, or averaging tank, should be set up, and the gas flowing into the holder adjusted to exactly fill it in the time during which the sample is to be taken. Care should be exercised to have the service from which the holder is filled short and of small piping, in order that an average sample may be obtained; or the sample should be taken from a line on which there is considerable consumption.

On unpacking the apparatus, see that it is clean and free from packing material. Set up the calorimeter so that the overflow and outlet water can be easily led to the sink. Make the water connections with rubber tubing, being careful not to cramp the tubing. To avoid air currents, caused by the movement of the observer's body, set up the calorimeter so that the water supply may be easily adjusted, and all temperatures readily observed. Lead the outlet water to a funnel a little above the top of the copper container used in collecting the water, so that the water can be shifted from funnel to container without spilling.

Set up the meter facing the observer, and level it carefully. Fill it with water slightly above the level mark on the gauge-glass. Connect the inlet pipe of the meter to the gas supply with rubber tubing. Fill the pressure regulator with water, then connect it with the outlet of the meter, and from the outlet of the pressure-regulator to the calorimeter burner. All rubber tubing used to connect the meter, pressure-regulator, and burner should be as short as possible. When fresh water or new gas-tubing is used for the first time, gas should be passed through the meter and all the gas connections for one or two hours before the test is made. This is necessary to ensure the saturation of the water and tubing with gas.

Turn on the gas, and allow it to burn for five or ten minutes. Shut it off at the burner, and watch the hand on the meter for leakage. Be sure that all leaks are stopped before attempting to make a test. Shut off the gas, remove the pressure, and draw off water from the meter until it is exactly at the point shown by the gauge. Start water running through the calorimeter, light the burner, and insert in the calorimeter. Then regulate the burner to consume at the rate of from 4 to 7 cubic feet an hour, as may be found by experiment to give the highest result with the gas to be tested, admitting enough air for the flame to show a faint luminous tip. The water should be so regulated that there is a difference between the inlet and outlet temperatures of about 15° Fahr. The inlet water temperature should vary little, if an overhead tank is used and no water added during the test.

Before making the test, the barometer, the temperature of the gas at the meter, of the room, and of the waste gas should be recorded. It is desirable to have the temperature of the inlet water and of the waste gases as nearly as possible at that of the room, in order to establish more nearly a thermal balance. Next allow gas to burn in the calorimeter for a period of 20 to 30 minutes. The test may now be started by shifting the outlet water from the funnel to the container just as the large hand on the meter passes the zero point. Readings are then made of the inlet and outlet thermometers, making them as rapidly as the observer is able to record them during the consumption of 0·2 cubic foot of gas. At least ten readings should be made. Water is again shifted from the container to the funnel as the hand passes the zero point the second time. The water is then to be weighed. The uncorrected heating value per cubic foot is obtained by multiplying the difference of the averages of the inlet and outlet temperatures by the number of pounds of water, and dividing by 0·2. This quantity is divided by the correction factor for barometer and temperature, obtainable from tables, so as to give the heating value at 30 inches pressure and 60° Fahr. The weight of the container should be obtained while the inside is wet. This may be done by filling it with water, emptying, and shaking for about five seconds in an inverted position. This will do away with any correction where several consecutive tests are required with same container.

The calorimeter, being a delicate and sensitive instrument, should be very carefully cared for when not in use. If the instrument is set up permanently, provision should be made that it be not disturbed by anybody except the operator. If it is not erected permanently, when dismantled it should be carefully cleaned inside and out, and the thermometers removed and packed in cotton.

It seems hardly necessary that instruction should be given for the care of such an instrument as the calorimeter; but certain precautions should be noted. Do not place a lighted burner in the calorimeter when hot water is not running through it. Do not shut off the water while the gas is burning; and if this is done accidentally, shut off the gas quickly to avoid breaking the thermometers. Do not move suddenly near the instrument during a test, as slight draughts thus caused will vary the outlet readings and vitiate the test. Do not forget to test the meter and all connections frequently for leakages. Do not make a test with the inlet water below the temperature of the room. Do not erect the calorimeter too close to any heating or lighting appliance, where radiant heat might affect the readings.

Suggestions for Further Investigation.

Your Committee, knowing that much could be learned by a further investigation of the subject of calorimetry, suggest the following topics, not with the idea that their investigation is necessary as an adjunct to commercial calorimetry as at present practised, but as a means of further enlightenment on the general subject as affecting close and scientific determinations: Effect on calorific readings resulting from a varying atmospheric humidity; effect on the heating value resulting from a difference in temperature between the inlet water and the atmosphere of the room; and determination of the heat lost through the products of combustion leaving the calorimeter above or below the atmospheric temperature.

Single Standard of Gas Valuation.

It has long been known by those having to do with the regulations governing the quality of gas to be supplied to the public that the candle power required for certain kinds of gas has been much greater than that needed for certain other gases. The difficulty of accurately expressing the utility value of the gas by "candle power" has been generally recognized by the more careful investigators, Municipal and State, endeavouring to do the regulating, and by gas engineers whose work is vitally affected by this regulation. Therefore it seems pertinent that some step should be taken whereby the product supplied could be more equitably compared and more readily referred to some serviceable standard or unit. This is particularly true under the present practice of supplying a mixture of several kinds of gas in varying proportions. It is also true, because of the great strides which have been made in the production of more efficient apparatus for transforming the heating value of gas into light, that the relative value of flame luminosity and candle power has become less.

The proportion of gas actually used for purposes where its candle power is of prime importance is quite small, and is becoming smaller. For all other purposes—such as heating, power, lighting by the use of incandescent mantles and similar devices—the heating value is clearly and beyond argument the simplest, clearest, and most satisfactory method of commercially valuing gas. This being so, the question has been raised in the minds of many as to whether we were not unnecessarily encumbering our regulations, adding unnecessary complications to our testing, and hampering the best commercial development of our gas-works and gas-making processes, by the use of a double standard.

The investigations of the Committee would, we believe, go to show that the heating value of gas can be easily and definitely determined; that the process of making this determination is a comparatively simple one; that, with proper instruments, the

personal error is small; and that, therefore, this way of testing the value of a given gas is decidedly preferable to the photometric method, for the reasons expressed above. We therefore respectfully submit the question for the careful consideration of the Institute, and suggest that it be passed on to next year's Technical Committee for further study; looking to a definite recommendation to the Institute at the 1909 meeting.

The report is followed by six appendices, giving a description and illustrations of the calorimeters tested, the portion of the Notification of the Metropolitan Gas Referees for the current year referring to the mode of testing the calorific power of gas, the results of some tests with the Junkers calorimeter by Dr. Immenkotter, tables and diagrams of test data, a bibliography of the subject, and a list of patents relating to it.

THE THEORY OF BENZOL ENRICHMENT.

By E. H. Earnshaw, of Newark (N.J.).

[A Paper prepared for the American Gas Institute.]

The whole matter of benzol enrichment is governed by a few comparatively simple physical laws. While a knowledge of these laws may not be sufficient to enable one to predict definite results, still a consideration of their application will point out reasons for many apparently contradictory experiences reported.

Every volatile liquid gives off a vapour at all temperatures. This evaporation is slow at low temperatures, but increases rapidly as the temperature of the liquid approaches its boiling-point. The force exerted by the vapour in making room for itself by displacing the surrounding air or gas is called vapour tension, and increases as the temperature rises.

Every mixture of gas and a vapour obeys the following two laws, known as Dalton's laws: (1) The tension, and consequently the quantity of vapour which saturates a given space, are the same for the same temperature, whether the space contains a gas or is a vacuum. (2) The tension of the mixture of a gas and a vapour is equal to the sum of the tensions which each would possess if it occupied the same space alone. By the application of these laws, we are able to predict with certainty the amount of any vapour required to saturate a given volume of gas at any designated temperature. A familiar example is to be found in the table of correction factors which we all use for determining the volume of gas at 60° Fahr. equivalent to 1000 cubic feet at another temperature—the gas in both cases being saturated with moisture. The tension of water vapour has been accurately determined for all temperatures, and in calculating the correction factor allowance is made for the volume of water vapour present before calculating the change in volume of the gas due to difference in temperature. For example: 1000 cubic feet of gas at 82° Fahr. and 30 inches barometer consists of 963·6 cubic feet of gas + 36·4 cubic feet of water vapour; at 60° Fahr. the total volume will be 941 cubic feet, consisting of 924·7 cubic feet of gas + 16·3 cubic feet of water vapour. In each case the weight of gas is the same, and the reduction of its volume is due only to the change in temperature. But nearly one-half of the water vapour has been condensed to water, and is no longer present with the gas. If now the 941 cubic feet of gas and water vapour at 60° Fahr. are again raised to a temperature of 82° Fahr., but out of contact with the condensed water, it will occupy a total volume of 980·6 cubic feet, consisting of 963·6 cubic feet of gas + 17 cubic feet of water vapour. This is now an unsaturated mixture, and is capable of taking up and carrying 19·4 cubic feet of additional water vapour, and thus increasing its volume to the original 1000 cubic feet.

The laws governing the enrichment of air or a fixed gas, like blue water gas, with pure benzol are exactly similar to the case of water vapour. The vapour tension of pure benzol has been accurately determined for various temperatures, and it is possible to predict with certainty the volume of benzol vapour that can be carried with the gas at any determined temperature. Consequently, the amount of enrichment, in candles, can be predicted, and with equal certainty the loss in candle power that will be sustained by cooling the mixture of gas and vapour to a temperature below its point of saturation. Unfortunately, however, the problem, as usually encountered, is far more complex. The gas to be enriched is not a simple fixed gas, but is already more or less completely saturated with vapours belonging to the same series of hydrocarbons as benzol. The so-called benzol used for enrichment is not pure benzol, but is chiefly a mixture of benzol, toluol, and xylol. These three hydrocarbons, belonging to the same series, in a liquid form dissolve perfectly in all proportions; but they have different boiling-points, and consequently different vapour tensions at the same temperature, as is shown by the following table.

Regnault has shown that the vapour tension of mixed liquids depends upon the mutual solubility of the liquids, in accordance with the following laws: (1) Where two liquids exert no solvent action on each other, such as water and benzol, the tension of the vapour which rises from these is nearly equal to the sum of the tensions of the two separate liquids at the same temperature. (2) When two liquids dissolve in all proportions, as benzol and toluol, the tension of the vapour of the mixed liquid is intermediate between the tensions of the separate liquids.

	Benzol.	Toluol.	Xylol.
Chemical formula	C_6H_6	C_7H_8	C_8H_{10}
Specific gravity, liquid at 60° Fahr.	0·8846	0·8720	0·8692
Specific gravity, vapour	2·6953	3·1792	3·6630
Boiling-point	177° F.	230° F.	287° F.
Weight of 1 gallon, lbs.	7·3700	7·2600	7·2400
Do. of 1 c. ft. vapour at 60° Fahr., lb.	0·2064	0·2434	0·2805
Cubic feet vapour from 1 gallon.	35·5700	29·7600	25·7700
Vapour tension at 60° Fahr., in inches of mercury	2·3460	0·7200	0·2360
Cubic feet vapour in 1000 cubic feet saturated mixture of gas and vapour at 60° Fahr. and 30 in.	78·2000	24·0000	7·8800

The first law of Regnault shows that the presence or absence of water vapour has no effect on the enrichment with benzol; it is the operation of the second law that causes all the trouble and uncertainty. The exact composition of the enriching liquid being usually unknown, it would be impossible to predict its vapour tension for any particular temperature; consequently its permanent enriching effect would be uncertain, even if the gas to be enriched were free from any other similar vapour. But if the gas to be enriched is a water gas or coal gas already saturated with vapours of the benzol series, the problem becomes still more complicated. Let us consider such a case.

Take a water gas already saturated with hydrocarbon vapour of (say) 20-candle power, and it is desired to effect a permanent enrichment of 2 candles by the use of commercial benzol. Let us suppose, in the first place, that the tension of the vapours with which a gas is saturated, already present in the gas, is the same as the vapour tension of the enriching liquid. It is evident in this case that no enrichment can be obtained, since the quantity of vapour of a given tension required to saturate a gas is always the same for the same temperature, and this fixed amount is already present in the gas. If the vapour tension of the enriching liquid is higher than that of the hydrocarbons in the gas, a degree of enrichment can be obtained.

The commercial success of such enrichment will depend upon the difference in vapour tension. It is evident that an increase in quantity of vapour, and therefore in candle power, can only be obtained by increasing the vapour tension of the hydrocarbons in the gas. If the tension of the enriching liquid is very high, the addition of a small amount may raise the tension of the combined vapours so that the gas will carry the quantity of vapour necessary to give the desired increase in candle power. In this case, the full enriching value of the added vapour is developed.

If the vapour tension of the enriching liquid is but little higher than that of the vapours already in the gas, then the desired enrichment can only be obtained at considerable cost, and the full value of the enriching liquid cannot be utilized. Enough of the benzol must be added to bring the average vapour tension up to the required point; but as the total quantity of vapour will now be much greater than the gas can carry, the surplus will be condensed. This condensate will have a tension higher than that of the original vapour in the gas, and lower than that of the enriching benzol. If the tension of the benzol is less than that of the vapours in the gas, not only will there be no enrichment, but there will be an actual loss of candle power. This is evident, because any addition of this benzol will lower the average tension of the vapours, and reduce the amount the gas can carry, and there will be condensed from the gas a quantity of liquid greater than that of the benzol added.

So far I have assumed that the gas remains at a constant temperature after enrichment; but this is not usually the case. The added candle power is, of course, permanent for any higher temperature; but if the gas is subjected to a lower temperature, the change in vapour tension must necessarily cause a deposition of liquid hydrocarbons, and consequently a loss in candle power. No one can predict with accuracy how great the loss will be for any given drop in temperature. This can only be determined by actual experiment. At first, the hydrocarbons condensed from the gas consist chiefly of toluol and xylol; but as the temperature is lowered and the deposition of vapours continues, the proportion of benzol constantly increases, both in the hydrocarbons of the condensate and in the vapours remaining in the gas. To understand clearly the cause of this action, let us assume that the lowering of the temperature occurs in successive steps. After each drop in temperature, the gas contains more hydrocarbon vapour than the quantity corresponding to the average vapour tension at the lower temperature, and the surplus is immediately condensed. The tendency is for the vapours of lowest tension to condense first, leaving the gas saturated with vapours of a higher tension. The operation of the law of average vapour tensions, however, causes an effort at readjustment, to the end that the average vapour tensions of the condensed liquid and the hydrocarbon vapours may become the same. If the gas should remain in contact with its condensate for a sufficient length of time, this readjustment would undoubtedly become complete; but in actual practice it is only partially effected, and the condensate contains a greater proportion of hydrocarbons of low vapour tensions than is found in the mixture of vapours remaining in the gas. It is also clear that each successive condensate will consist of hydrocarbons of a lower average boiling-point than the preceding one.

To determine the quantity and character of the hydrocarbons

condensed from water gas by lowering its temperature, the following experiment was made. A water gas of approximately 24-candle power, made from Texas oil, was passed through a cooling coil arranged in such manner that the condensate deposited between two determined temperatures could be collected and measured.

Condensate of Oil from Water Gas.

Temperature. Deg. Fahr.	Illuminating Power. Candles.	Gallons of Condensate per 1000 Cubic Feet.	Average Candle Power Lost. Candles.	Apparent Enriching Value of Condensed Oil. Candle-Feet per Gallon.
70 to 60	24·2	0·063		
,, ,,	23·3	0·065	0·064 Av. 0·91	14,200
,, ,,	23·1	0·064		
60 to 50	24·4	0·079		
,, ,,	24·7	0·082		
,, ,,	23·6	0·075	0·077 ,, 1·55	20,100
,, ,,	23·6	0·072		
50 to 40	24·0	0·074		
,, ,,	23·9	0·079	0·073 ,, 1·72	23,500
,, ,,	23·4	0·065		
40 to 30	23·0	0·071	0·071 ,, 2·46	34,600
70 ,, 30	—	—	0·285 ,, 6·64	23,300

It will be noticed that the quantity of condensate collected for each 10° drop in the temperature remains very constant; but the apparent enriching value increases as the temperature falls. This is probably due chiefly to the greater quantity of high-tension hydrocarbons in each successive condensate.

The distillation of the condensate between 70° and 50° and between 50° and 35° shows very clearly the increase in the percentage of benzol by volume in the condensate collected between the lower temperatures.

Distillation Test of Condensates from Water Gas.

	Between 70° and 50° Fahr.	Between 50° and 35° Fahr.
Up to 202° Fahr. (chiefly benzol)	17·1 per cent.	28·1 per cent.
202° to 260° (chiefly toluol)	28·4 ,,	43·2 ,,
260° ,, 302° (chiefly xylol)	33·7 ,,	16·7 ,,
Above 302° (heavy tar oils, &c.)	13·9 ,,	6·6 ,,

These principles cover, in brief, the whole theory of benzol enrichment; and their application to practical problems may explain some apparent contradictions, and perhaps prevent some of us from attempting the impossible. For example, it is evident that disappointing results are sure to follow any attempt to enrich at the works water gas which is subsequently to be exposed to a considerably lower temperature. A better effect will be obtained by enriching at an outlying holder station, since the gas has been exposed to a lower temperature than at the works; but even in this case a high grade of benzol will be required in the winter months. During the summer months it is quite possible to satisfactorily add a certain amount of enrichment to any gas which has been exposed during manufacture to a lower temperature than it will subsequently meet in distribution; and in this case a benzol of low grade will frequently do the work. In general, any gas can be economically enriched with benzol if it is not already saturated with hydrocarbon vapours, and will not be subsequently exposed to a temperature that will lower the tension of the mixed vapours so that they will condense out in a liquid form.

I have in mind an instance where coke-oven gas is distributed a distance of 70 miles at an initial pressure of 30 lbs. During the cold weather this gas suffers a loss of illuminating power due to the compression and subsequent cooling, and it reaches the distribution holder at the end of its journey considerably undersaturated with hydrocarbon vapour. It has been the practice to restore the lost candle power by enrichment with benzol; and for this purpose a high-grade (90 per cent.) benzol was at first employed. Subsequently it was found that the gas was so far from being saturated with hydrocarbon vapours that a 60 per cent. benzol gave a satisfactory permanent enrichment. During the spring months, the ground is still cold, causing a loss in candle power, though less than during the colder months; and it was found that the 30 per cent. benzol collected from the pipe-line drips in the winter was good enough to give the small permanent enrichment then desired.

The approximate composition of the several benzols used for enriching in this particular case are shown by the following distillation tests:—

	90 per Cent. Benzol.	50 per Cent. Benzol.	Drip Oil.
Up to 181° Fahr.	1	2	3
181° to 194°	50	6	3
194° ,, 212°	35	53	26
212° ,, 230°	8	25	18
230° ,, 248°	—	12	14
Above 248°	—	5	35

In conclusion, I wish to emphasize the point that every case in which it is desired to use commercial benzol as an enricher must be treated as an independent and separate problem, and considered in the light of the known laws. The degree of saturation of the gas, the amount of enrichment desired, the temperature to which the gas will be exposed after enrichment, the grade of benzol available—these are the controlling factors; and they must all be reckoned with.

Masonic.—W. Bro. J. B. Fenwick, P.M. of the Vernon Lodge, No. 1802 (Gas and Water Engineer to the Retford Corporation), has been appointed P.G. Sword Bearer for Nottinghamshire.

SCIENTIFIC CONTROL OF FUEL CONSUMPTION.

At the last Meeting of the Iron and Steel Institute, a paper on the above subject was read by Mr. H. E. Armstrong, F.R.S., Professor of Chemistry in the City and Guilds of London Central Technical College. The following are some extracts from the communication.

There must be not a few, at the present day, who find it difficult to remain calm when they reflect on the ruthless way in which the world's accumulated stores of raw material—of timber and iron, and especially of fuel, both coal and oil—are being used up, who shudder when they notice the indifference displayed in all civilized lands to the consequences which must accrue from such waste in by no means distant times to come. We calmly allow the unrestricted export of the staff of our manufacturing life as though it were nothing more than a mere stone, without realizing that we are parting with our heritage at a very small fraction of the potential value. The public may comfort itself with the belief that "science" will discover a substitute for coal, and therefore feel no compunction in recklessly destroying the capital won from the sun in ages past, and banked just within our reach in the surface layer of the crust of the globe. But, in reality, "science" at present can give no support to the illusion, and is in duty bound to preach prudence to the world.

The supply of coal in our islands cannot last many centuries. But it is useless to dwell on the distant future, when it is known that already the pinch is being felt, and that a variety of circumstances are tending to raise the price of fuel to a point at which it becomes a more or less serious hindrance to industrial advance, and consequently to public well-being. More, it is unnecessary to urge. All who are capable of thinking on such matters are aware of the gravity of the situation, and must feel the need of a constructive policy. But two courses are open. The one involves economy and such improvements as are possible in the practice of present methods of consuming fuel; the other, the introduction of methods which are potentially of higher efficiency. In either case, success can arise only from more attention being paid to the root conditions of the problem.

Great advantage is to be derived from the employment of automatic methods of registering continuously the extent to which the oxygen in the air is utilized, because this affords a check on the manner in which fires are attended to, and is therefore a means of securing regular stoking; also because undue loss of heat is avoided if care is taken that the maximum proportion of carbon dioxide is present in the gases that escape into the flues. The use of automatic apparatus for the continuous registration of temperature is also, for similar reasons, often of importance, and becomes indispensable when the maintenance of a steady heat is a condition of success. But my object on the present occasion is to plead for something more than the mere occasional control of fuel consumption, whether in iron-works or elsewhere; it is to plead for the introduction of a new attitude towards the problems of combustion and fuel economy—an attitude of understanding based on sympathetic and serious contemplation of the phenomena, an attitude of real and deep appreciation.

Everyone, of course, knows that fire is produced by the oxygen of the air combining with the carbon and hydrogen of the fuel. Few realize, however, that the statement is but the barest gloss upon the facts. The chemical student writes $C + O_2 = CO_2$, and feels that he has said all that the examiner can demand. And while coal is treated as of some consequence because it is paid for in hard cash, little consideration is given to the part which air plays. The fact that it is equally worthy with coal to be treated as fuel, is seldom recognized. Air being always at hand, it is supposed that it costs nothing; but in reality its use is often attended with no inconsiderable expense (quite apart from that involved in the construction of the smoke-shaft), sometimes because it is used too sparingly, more often because it is used too lavishly.

The extraordinary complexity and the wondrous beauty of the phenomena of combustion are only beginning to dawn upon us. Even the problems to be solved are perceived only dimly. The fire sense has yet to be cultivated, in fact. To give an example, not so long ago we thought of carbonic oxide and hydrogen gases and of charcoal as just combustible substances. Bring any one of them together with oxygen, and make the mixture hot enough, it was sure to inflame. A rude shock was given to this pristine simplicity of belief when Mr. Harold B. Dixon made the memorable discovery in 1883 that if the gases were carefully dried, a mixture of carbonic oxide and oxygen was uninflammable—the presence of moisture being essential to combustion. At the same time he showed that, up to a certain point, the rate of oxidation was dependent on the proportion of moisture present. Similar proof was given by his pupil, Mr. H. Brereton Baker, in 1885, that in the case of charcoal, and even of the still more inflammable substances phosphorus and sulphur, the occurence of combustion was dependent on the presence of moisture. A new era was opened by these discoveries.

In discussing Mr. Baker's work, I drew attention to Faraday's great generalization that chemical and electrical action are essentially identical; contending that, from this point of view (of the essential unity of the phenomena of chemical and electrolytic change), it was necessary to conclude that the conditions determinative of chemical change were those which prevail in every

voltaic circuit, the one indispensable element of which is an electrolyte—that is to say, a substance that is capable of conveying an electric current. As water is not an electrolyte, the presence of water alone should not suffice, on this assumption, to condition change. Something must be present in it—some impurity—to render it conducting. This prediction was verified in 1902 by Mr. Baker, who showed that, if proper precautions are taken in preparing the gases, a mixture of hydrogen and oxygen is inexplosive at a red heat, even when liquid water is visibly present. Under ordinary conditions, the impurities present are sufficient to render the water conducting and to determine the occurence of change. Observations such as these have revolutionized our knowledge of the phenomena of combustion.

Of late years, the study of the combustion of hydrocarbons has led to great progress being made in another direction of importance. The subject is one which has given rise to endless differences of opinion. It was long supposed that the hydrogen was the more combustible constituent; but then came a period during which the carbon was regarded as preferentially burnt. Thanks to the labours of Dr. W. A. Bone and his co-workers, we have now gained some insight into such matters; and, needless to say, our old simplicity of belief has been rudely disturbed. The hydrocarbons, it seems, are broken down gradually—partly by direct oxidation, partly by thermal decomposition. The primary —indeed the sole—oxidation process, however, appears to be one of hydroxylation; the hydrogen of the hydrocarbon being gradually displaced by the group OH, which chemists call hydroxyl. It may therefore be said the hydrogen is the more combustible constituent, as it is the first to suffer dislocation; but as the entrant oxygen is shared by the carbon and hydrogen in the hydroxylated product, it may be claimed that honours are divided.

I have probably said enough to make it clear that it is impossible to understand the changes which attend the combustion of carbonaceous fuels without considerable appreciation of organic chemistry. But we are only at the beginning of our knowledge of such matters. We know almost nothing of the influence of surfaces on the interchanges involved in combustion, except that they exercise a profound influence. And yet all furnace operations are carried out within boundaries which presumably play a determining part beyond that of a mere enclosure. Almost the only practical worker in this field was the late Frederic Siemens, whose name is so well known, together with that of his brother, the late Sir William Siemens, in connection with the regenerative furnace. But his labours seem to have passed into oblivion. No subject is of greater importance from a practical point of view. The effective use of gaseous fuel in the future for the purpose of raising steam and in many other ways, especially in substitution for our present wasteful system of domestic heating, must depend on the advance of knowledge in this field. The inefficiency of gas-stoves as now supplied does not bear thinking of. If gas engineers had any understanding of such matters—any scientific conscience—and were not merely engaged in producing gas for sale, with little reference to quality and the results obtained by its use so long as mere statutory obligations are satisfied, they would hesitate before advocating the employment of the appliances that are now foisted on an unwary public. Clear proof that advance is possible is afforded by Auer von Welsbach's discovery of the incandescent mantle. But it is worth while noting that the effective radiant in the mantle is a substance present to the extent of little more than a fraction of a per cent., and that at most two or three substances are known to be available for the purpose. How long the supply of these materials will hold out, we cannot say; but the question is one of no little importance.

Fuel is like food—quality being of importance as well as quantity. In the first place, the constituents which remain as ashes merit more attention than they receive. The possibility of preventing clinkering, by mixing different varieties of coal or by suitable additions, is rarely taken into account. The escape of sulphur also receives no proper attention; it probably constitutes a far more serious nuisance than that of smoke production, owing to the effects produced on vegetation and on buildings, especially on iron structures. It is also not improbable that it contributes to no inconsiderable extent to produce fog. Being invisible, the sulphur compounds in smoke do not openly invite resentment; yet the subject is one which must attract public attention at no distant date, if only as a consequence of the unbridled licence now allowed to gas engineers. During generations every effort was made to discover means of reducing the amount of sulphur in coal gas; but of late years science has been thrown overboard, actually by Act of Parliament. Sulphur purification is now practically abandoned—on false grounds of economy—with most unpleasant consequences to consumers' comfort and furniture. In the end, such a policy must operate seriously against gas interests, and favour the more general adoption of electricity.

To pass to the most important side of the subject, it should be pointed out that fuel is not to be judged only on account of its heating power as determined in the laboratory. Thus hydrogen and carbonic oxide gases have practically the same heats of combustion, measured at ordinary temperatures at which water is liquid. At temperatures at which water is gaseous, however, the heat of combustion of hydrogen is reduced in value to the extent of nearly one-eighth, and falls considerably below that of carbonic oxide. Of the two, carbonic oxide is therefore the more effective fuel. Moreover, perhaps owing to its peculiar insensitiveness to oxidation, it seems in a measure a milder fuel; and the products of combustion of the two gases—water and carbon dioxide—appear to exercise very different effects, in the re-heating furnace, for example. Refinements such as these, however, have as yet scarcely entered into consideration in manufacturing operations; but it has to be recognized that they are of consequence in connection both with the production and with the use of producer gas. In course of time, it may also be considered desirable to pay some attention to the composition of the gas supplied for domestic purposes—to deliver a product produced by some more rational process than that involved in coking coal. But so long as the manufacture of gas rests with the engineer alone, and not with the chemist, the public must suffer the consequences which always attend imperfect administration.

In the case of solid fuel, it is well known that no two coals yield quite the same quantity of flame, and that mechanical differences also play a very important part in modifying combustion. Apparently it is chiefly because changes take place which involve mechanical alterations, not because there is any material loss of calorific power, that steam coal loses its value when stored for any considerable period. The advantage derived from mechanical stoking probably does not arise merely from its being more economical, but also from the fact that combustion takes place in a more nearly uniform manner than when coal is introduced at intervals; the flame retaining its character in consequence of the steady introduction of bituminous matter from which hydrocarbons are distilled off which burn with a more or less luminous flame. These are all matters which, in future, must receive much more attention than they have had in the past. The study of radiation phenomena is yet in its earliest infancy; and the value of water-softening appliances is still far too generally over-looked.

To pass from the consideration of methods in use to that of methods potentially of far higher efficiency than any of the purely thermal processes now at our disposal, we can at present only look forward to the direct conversion into electrical energy of the energy latent in fuel. To say that this is impossible would be absurd; but it is useless to exaggerate the difficulties. Hydrogen can be burnt electrically in the Grove gas-battery; but there is no economical process of preparing it. It can, however, be obtained by passing steam over red-hot coal, but only in admixture with carbonic oxide. Why not burn such a mixture electrically? it may be asked. Strange to say, not only are we unable to substitute carbonic oxide for hydrogen in a gas-battery, but it puts a stop to hydrogen being used in one if mixed with it. Why this difference should obtain between the two gases, both being combustible, we scarcely know, though we may guess at the reason. Why carbonic oxide hinders the electrolytic oxidation of hydrogen entirely passes comprehension. It is problems such as these that we need to solve before any substantial advance can be made.

I have drawn attention to the complexity of the issues involved in the proper use of fuel, in order that it may be clear that, if we are to advance and effect the economies which we are morally bound to aim at introducing with the least possible delay, a more philosophical treatment must be secured for the subject. We need both to dispel public ignorance and to excite public interest in such matters. This can only be done by the schools. Everyone is a user of fuel, and it is a matter of consequence to all that it should be used in a thrifty manner; therefore it should be a subject of real study in our schools. If these did their duty, and made some attempt to live up to the knowledge of the times, the young student of engineering would enter college prepared and qualified to take an interest in all subjects bearing on his professional activity. This is certainly not the case at present. Whether it be that those who are attracted to engineering represent a particular type of mind, or whether it be a consequence of the intense conservatism bred in the English schoolboy—I suspect that both causes have been in operation—in my experience, the engineering student has a strange tendency to limit his mental horizon. But I am glad to say he is changing with the times, and that, while formerly he scoffed at chemistry and other subjects not specifically included under engineering, he is now beginning to appreciate their value. He is slowly being led to realize that chemistry is the most fundamental of all sciences, and that unless he has acquired some mastery of its principles he cannot understand the nature of the materials he employs, nor the changes to which they are subject under the conditions of practice.

But in the works the engineer must remain an engineer; his mental attitude can never be that of the trained chemist. In all operations involving the occurrence of chemical changes, the chemist must be at his side; otherwise the work can only be conducted in an empirical and more or less perfunctory manner. I believe this to be one of the great lessons to be learnt by English manufacturers at the present day. The chemist is rarely employed in our works. The majority of those called chemists in works are not chemists in any proper sense of the term, but merely "analysts" engaged in controlling the quality of the materials used and of the products. More often than not, they are not allowed access to the works proper, and have little or no opportunity of becoming chemists by familiarizing themselves with the actual operations, and reflecting on and inquiring into the nature of the changes which are involved in the processes. Worst of all, they are not called upon to undertake systematic research work. The great success of German manufacturers in recent times is far less a consequence of the training given in the universities and technical schools than it is of the establishment within the works of research laboratories in which the problems that the industry affords are systematically studied. Until the German

example is followed, we shall do little to place our industries on a scientific basis, as the proper scientific atmosphere and spirit must be lacking in the works, and the opportunities they afford must necessarily remain unheeded and unexploited.

It should be borne in mind that the chemist proper is a man whose imaginative faculties have been cultivated to such a high degree that he has gained the power of seeing into the very heart of the processes he directs. The mind of the engineer leans more towards the constructive side. In attributes and functions, the two are no more alike than are the painter and the musical composer. In all industries dealing with chemical processes, their labours should be conducted on parallel lines, in a spirit of mutual co-operation. The gas industry is a striking illustration of the danger of overlooking this need. On the engineering side, it has been developed to a remarkable pitch of perfection; on the chemical side, it still remains the barbaric process it was at its inception—the engineer having always assumed control, practically to the entire exclusion of the chemist.

If the consumption of fuel in our works is to be the subject of scientific control in order that economies may be effected, it will be necessary to secure the services of a special class of chemists—of men gifted with real chemical feeling qualified to study the problems which the consumption of fuel affords. Such men must be properly paid, and in every way rank on an equality with members of the engineering staff. They should have enough knowledge of engineering to be in full sympathy with their engineering colleagues, who, in turn, should be sufficiently versed in chemistry to appreciate the chemists' behests.

The whole subject is of Imperial and urgent importance. It is imperative that an organized attack should be made without any delay on the problems which await solution, as so many are concerned in effecting improvements likely to conduce to the economical use of fuel. Someone must take the lead; and I therefore venture to bring this appeal before the Institute, as the leading body of fuel-users in our country. As to means, I would suggest that the Government be asked to impose a tax for the purpose (say) of 1s. per ton of coal raised, and of several shillings on every ton exported for foreign use. This would bring home to our public the importance of conserving our irreplaceable stores of fuel.

REGISTER OF PATENTS.

Stoking Machinery.

ROBERT DEMPSTER AND SONS, LIMITED, and TOOGOOD, H. J., of Elland.

No. 27,766; Dec. 17, 1907.

In retort charging and discharging machines and the like, it is necessary (as the patentees mention) to drive the machine over a great range of varying speeds; and the direction of movement of the gear requires to be reversed very frequently. For these reasons, "electrical power, though otherwise not considered desirable, is generally used for actuating this class of machines."

The primary object of the invention is to provide mechanical means whereby machines of this class can be easily driven at any desired speed, started, stopped, or reversed. For this purpose, there is combined with one or two expansible pulleys and an epicyclic gear-train a constant-speed driving rope in such manner as to convert the constant speed in one direction of the driving rope into a variable speed in either direction obtainable from a countershaft. It has previously been proposed to convert, by means of an epicyclic gear-train combined with one or more pairs of expansible pulleys—one pulley driving another by an endless band or chain—a rotary movement at a constant speed in one direction of one shaft, into a rotary movement at a variable speed in either direction on another shaft. But according to this invention, the power driving the whole machine can be communicated directly from a driving rope to one or more of such expansible pulleys, which form part of a travelling machine and receive the drive at any point in the travel of such machine.

The general arrangements here protected were fully described and illustrated in an article that appeared in the "JOURNAL" for Feb. 11 last, p. 346.

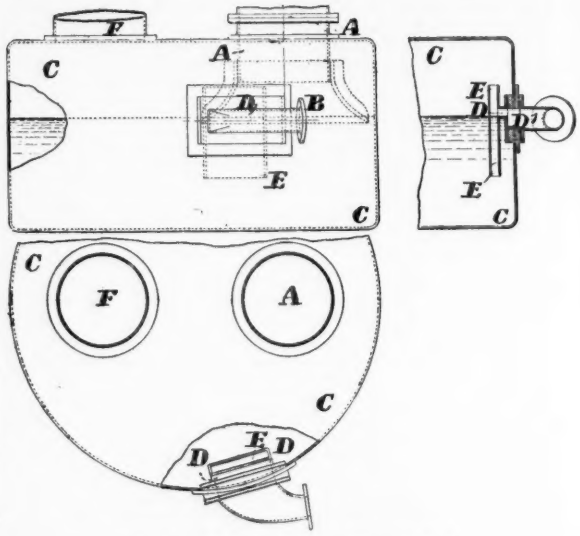
Back Pressure-Seal and Washer Overflow in Carburetted Water-Gas Plants.

CARTER, S., of Garston, near Liverpool.

No. 1406; Jan. 21, 1908.

The patentee remarks that the back-pressure seal of a water-gas plant, as commonly arranged, comprises a pipe of uniform bore (communicating with the superheater), the end of which dips into a cistern or reservoir (the "washer") partially filled with liquid; the seal being some 3 to 4 inches in depth. The liquid overflow consists of a circular orifice communicating with a seal-pot by means of a suitable pipe connection. Inasmuch as a circular orifice necessitates an increase in the depth of liquid passing through it, to admit of sufficient sectional area of stream to accommodate a copious flow of liquid (and the depth is reduced when the flow of liquid decreases), the depth of the seal must necessarily fluctuate according to the amount of liquid flowing through the cistern. Also, when a large volume of gas is passing through the apparatus, a greater back-pressure obtains than the depth of seal of the dip-pipe. The results of these conditions are: Decrease in the yield; fouling of the take-off pipe or pipes; and deterioration of the illuminating power of the gas.

According to this invention, the end or mouth of the dip-pipe is enlarged, and preferably bell-shaped; and the cistern overflow is provided with or constitutes an orifice of greater length than depth, in order that the liquid level of the cistern may remain practically constant, irrespective of the quantity of liquid flowing through it. Thus "a small and almost unvarying seal may be maintained." The proportions of the areas of the cistern and dip-pipe are such that, although the surface of water within the cistern may be subjected to considerable backward pressure, its level will not be affected appreciably.



Carter's Water-Gas Back-Pressure Seal.

The illustration shows the application of the invention to a carburetted water-gas washer—an elevation and a plan (partly in section); also a section of the liquid overflow orifice.

A is a dip-pipe from the superheater of the plant, and B is an enlarged end or bell-shaped mouth. It is not essential, however, that the mouth of the dip-pipe should be bell-shaped, as the enlargement may take any contour which will present an extended "line" to the gas, to facilitate its escape from the mouth of the dip-pipe to the surface of the liquid in the cistern C, and so reduce the depth to which the liquid must be depressed to permit of the escape of the gas. D is a liquid overflow orifice of greater length than depth; and D^1 is a "chamber" below the orifice D into which the liquid falls, and thence it passes to the seal-pot. The liquid outlet from the cistern C thus, in effect, constitutes a weir. E is a T-pipe, open top and bottom, through which the liquid passes to the orifice; and F is the pipe through which the gas leaves the washer.

Electrically Igniting Gas Burners or Lamps.

HILL, A. J., of Woodford Green, Essex, and MANN, F. C. D., of Hayes, Kent.

No. 4550; Feb. 28, 1908.

This invention has reference to electrically igniting gas-burners or lamps, and is more particularly intended for use in railway coaches fitted with inverted incandescent gas-burners. The invention may, however, be applied to other forms of gas-lamps.

The invention is of the type in which the gas is ignited by a high-tension current affording a spark across a spark-gap arranged in proximity to the burner; the current being derived from an induction coil and source of low-tension current. Any ordinary type of apparatus is used—preferably arranged together in a portable manner; the coil being provided with flexible high-tension leads and terminal plug for connecting with the electrical system.

The leads for the high-tension current are carried from the terminal boxes, and are connected to brackets or terminals fixed in position by insulating washers; and these brackets are provided with electrodes sheathed in insulating material and having naked ends carried towards and situated near the burner, so that a gap is afforded between the free ends of the electrodes. The brackets are preferably clamped upon the baffle plate of the lamp above the burner, and may with advantage be arranged vertically. The electrodes which are secured to the lower part of the brackets are in this case horizontal or approximately so, and are arranged convergent one to the other; so that, while the brackets are some little distance apart, the projecting points of the electrodes forming the spark gap approach one another and may be curved inwards actually to face one another.

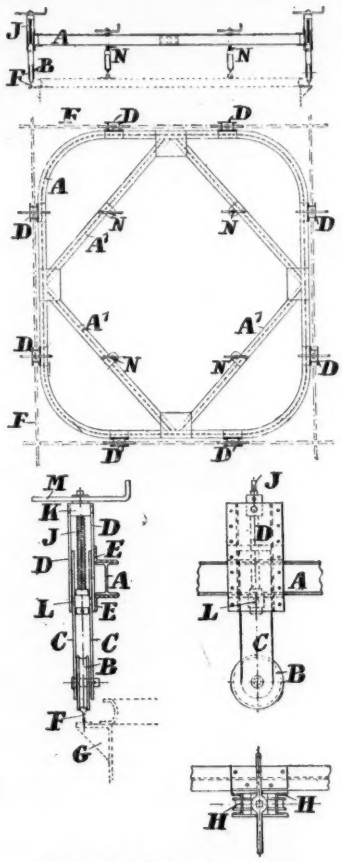
Lifting Carriages for Gas Purifiers.

HISLOP, R. F., of Paisley.

No. 4308; Feb. 26, 1908.

This device, for use in lifting the covers from gas-works purifiers of the luteless or other type, and for carrying and depositing them at another point, is represented in plan and elevation, with details of the lifting brackets hereafter described. This device consists of a framing A of H-iron, having cross-stays A^1 fixed to framing at suitable points. The carriage is made preferably of about the same length and width as the purifier, and is supported above it by wheels B fixed between the plates C sliding in a box-bracket D secured to the framing by cleats or angles E, the wheels running on rails F fixed to brackets G on the sides of the purifiers.

For the purpose of moving the carriage either in line with or across the width of the purifiers, the brackets with wheels are placed preferably two on each side of the framing near the corners. The brackets, bolted to the framing with cleats, as described, consist of two wrought-iron plates held apart with channel irons H or distance-pieces, and so forming a chamber or box for guiding the slide plates referred to. The raising and lowering of the slide plates is accomplished by means of the



Hislop's Purifier Cover Lifter.

screw J passing through screwed boss K fixed to the top side of the bracket D; the other end of the screw being attached to a pin L between the slide plates C. The screw is operated by a handle M fixed at the top. At convenient points on the bracing A^1, vertical lifting screws N are provided for raising or lowering the cover of purifier by attachment to corresponding eyes.

Scrubbing or Cooling Coal Gas or Water Gas.

M'Ilhenny, J. S., of Washington, D.C., U.S.A.

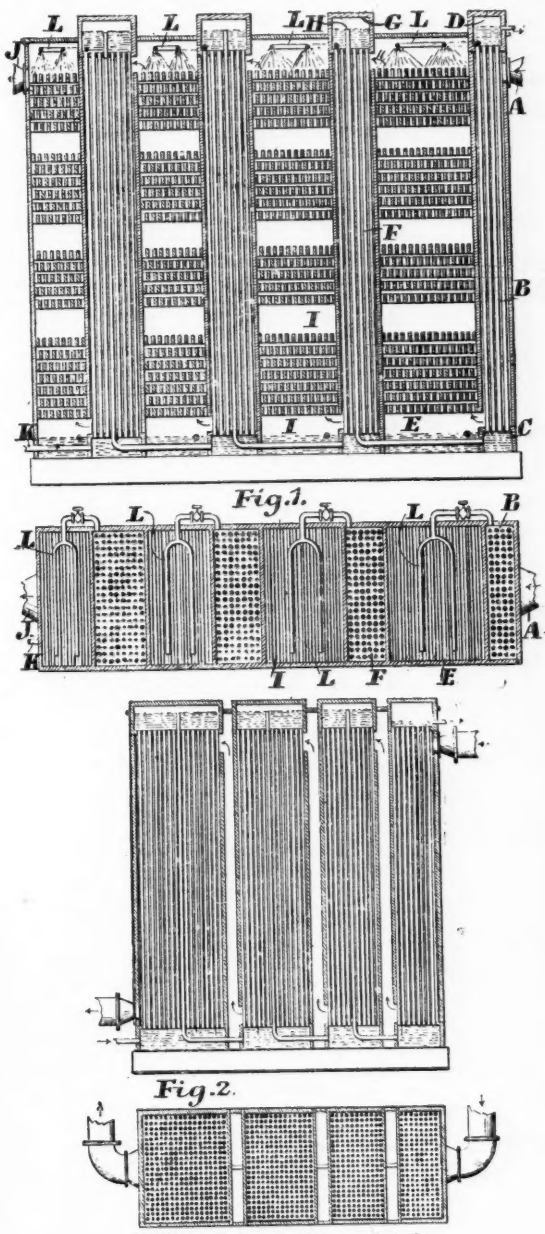
No. 8729; April 21, 1908.

This invention relates to methods of treating coal gas or water gas intermediate between the retort or generator and the distributing system. It has for its object: First, to more effectually remove the tar and heavy hydrocarbon oils precipitated by a reduction in temperature of the gas after it leaves the generator; secondly, to provide for a gradual cooling of the gas; thirdly, to provide an alternate cooling and scrubbing whereby the gas will be successively subjected to these steps in a series of stages—each stage of cooling being immediately followed by a stage of frictional scrubbing; and, fourthly, to provide, if desired, for successive washings of the gas with water at substantially the temperature of the gas at each washing step. By the method suggested, not only is the gas passed through a condenser in the opposite direction to the flow of the cooling medium, but the speed of the gas is successively decreased while subjected to the cooling action. Or the speed of the cooling medium may be increased, or the two features combined.

Fig. 1 is a vertical and horizontal longitudinal sectional view of the combined condenser or cooler, scrubber, and washer. Fig. 2 illustrates a condenser or cooler alone for carrying out this invention so far as it concerns cooling.

Near the top of the apparatus is tapped a pipe A leading from the hydraulic main of a coal-gas apparatus, or the seal-box of a water-gas generator, into a chamber B containing a series of vertically disposed pipes for conveying a "suitable cooling medium," such as water. The chamber B is provided at its bottom with a compartment C, into which the vertical pipes are tapped, and at its top with a similar compartment D, receiving the upper ends of the pipes, and having connected therewith a discharge pipe for the water. The chamber B is sealed gas-tight except at its lower end, where there is an opening leading into the adjoining chamber E filled in the usual manner with any "scrubbing apparatus," such as slats. It is closed gas-tight except at its upper end, where an opening is provided communicating with the next adjoining chamber F, substantially similar to B, being provided with water circulating pipes and upper and lower compartments. Nested within the pipes, however, is a series of overflow pipes H—whose upper ends terminate some distance above the bottom of the chamber G and within it, and which, at their lower ends, are turned horizontally and lead through the lower end of a chamber E into the lower compartment C of the chamber B.

Next to the chamber F is a scrubbing chamber D, similar in construction to the chamber E, and which communicates with the chamber F at the bottom through an opening. Similarly there are provided to the left of the chamber, alternately, cooling chambers and scrubbing chambers; the former chambers being provided with upper and lower compartments similar to the compartments of the chamber B, and with similar vertical piping, the upper compartments of which communicate with the lower compartments of the next cooling chambers in a manner identical with the communication between the chambers F and B through pipes H. The alternate chambers are provided with apparatus similar to chambers E I, and the points of communication between all the chambers is such that the gas passes up through the scrubbing chambers and down through the cooling chambers. The last scrubbing



M'Ilhenny's Gas-Scrubber and Cooler.

chamber has communicating with it, at its upper end, a gas-main J leading to the distributing system; while a pipe K leads from the exterior into the lower compartment of the last cooling chamber to supply the cooling medium to the apparatus.

It will be observed that the cooling chambers gradually increase in size from the entrance side of the gas towards its exit side; and, reversely, the scrubbing chambers gradually decrease in size. With a sufficient supply of gas, entering at A (say, at a temperature of from 120° to 200° Fahr.), owing to the comparatively small area of the chamber B, the gas will pass through the chamber at a comparatively rapid rate, and be discharged therefrom into the lower end of the scrubbing chamber E. The cooling medium in the pipes of the chamber B, having by its passage through the cooling chambers absorbed heat from the preceding gas, has reached the pipes at a temperature not much below that of the gas in the chamber B, so that the cooling action of the gas in the chamber is comparatively slight—due not only to this fact, but also to the fact of the rapid passage of the gas

through the chamber, on account of the small area of the latter. The gas entering at the bottom of the scrubbing chamber E filters slowly up through the slats, due to the much larger area of this chamber as compared with the chamber B, and is deprived of much of the heavy tars and water contained therein—the temperature of the gas being but little lowered. The gas then passes from the top of the chamber E into a cooling chamber F, where, owing to its somewhat larger area as compared with chamber B, it passes downward more slowly than through the chamber, and yet faster than through the scrubbing chamber E. The cooling medium in the pipes of the chamber F, being necessarily somewhat cooler than that in the pipes of the chamber B, further reduces the temperature of the gas; and this reduction is greater by comparison than in chamber B, owing to the larger area of exposure in chamber F and the consequent slower movement of the gas through it. The gas passing from the bottom of the chamber F into the scrubbing chamber I is subject to scrubbing action similar to that in the chamber E, except that, as chamber I is somewhat smaller than E, its passage through it is faster. Successively the gas passes through the other chambers—its speed through the scrubbers increasing, and its speed through the cooling chambers decreasing—and out to the distributing system through the main J. In a similar manner the cooling medium (water) is supplied through the pipe K, and passes successively through the piping in the several chambers; it being observed that the size of the chambers successively decreases, so that the cooling medium must necessarily proportionately increase its speed in its passage and become proportionately heated, the result being that the gas temperature is gradually reduced by successive and increasing exposures to the cooling medium, the latter being in each of the cooling chambers at a temperature but little below that of the gas. The result of this combined scrubbing and gradual cooling is that "the removal of tar or ammonia and other deleterious substances is effectually accomplished, and without the re-absorption of any of the illuminants: thus providing a rich, clean gas for the distributing system."

It is frequently desirable that, in addition to the frictional scrubbing, the gas be subjected to washing action in the scrubbers; and this is accomplished by locating at the top of the scrubbing chambers spraying pipes L; the pipes of each chamber being supplied with water from the preceding cooling chambers, suitable cut-offs being provided to regulate or cut off the flow.

In fig. 2 is a modified construction, in which the scrubbing chambers are dispensed with, the casing containing a series of cooling chambers alone with small intervening spaces providing upward passages for the gas between the chambers, as shown by the arrows. This apparatus is designed for use in plants where other means are employed to scrub the gas, and is intended solely for the gradual cooling of the gas in the manner already described.

Burning-Off Gas-Mantles.

DREHSCHMIDT, H., of Tegel, near Berlin.

No. 13,204; June 20, 1908. Date claimed under International Convention, Nov. 8, 1907.

This invention relates to the burning-off of gas-mantles for inverted incandescent lamps working with high-pressure gas.

It is well known, the patentee points out, that in such lamps the mantles are so large that the difficulties of transport in the burnt-off state are greatly increased. In order to avoid these difficulties, it has already been proposed to burn the mantles *in situ* and transport them in the unburnt state; and the present invention deals with a particular method of doing this.

The inventor proposes that the lamp should be provided with a burner-head having holes in it inclined outwardly and downwardly. In this way, the flame issuing from the burner is caused to play evenly on all parts of the mantle and "efficiently penetrate through the meshes of the mantle."

The outwardly inclined spreading burner head may be formed in any convenient way, as by means of holes bored in the body by stamped out plates, or by means of sieves laid over one another. He makes no claim to the burner itself, and such burner-heads are sufficiently well known not to require illustration. He further does not claim as his invention the employment of a burner having double plates in the burner-head or tip for the purpose of giving a regular flow of combustible to the mantle, so as to obtain a proper shaping of the mantle. His present invention is restricted to "the employment of a burner having a head provided with holes inclined outwardly and downwardly for the purpose of burning impregnated but unburnt mantles."

Spirally Guided Gasholders.

DEMPSTER, R., and R. & J. DEMPSTER, LIMITED, of Manchester.

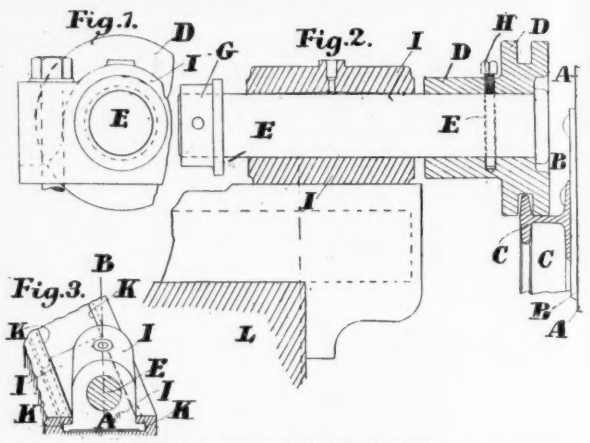
No. 14,627; July 10, 1908.

This invention has for its object to provide means whereby the axles or shafts of the guide-rail rollers of spiral holders are, when mounted, capable of movement away from or towards the centre of the holder.

The patentees point out that it is usual to provide guide-rollers loosely mounted upon axles, themselves rigidly supported by the roller carriages; a certain amount of "clearance" between the roller and carriage being also provided to allow for expansion of the holder due to heat, and for slight inequalities in action during the rise and fall of the holder. It so happens, however, that in the case of very large holders, the expansion may be so great as to make it possible for the sheeting or rail plates thereon to come in contact with the ends of the roller axles—"thus introducing a defect, and possibly a serious danger through interference with the free rise and fall of the gasholder or lifts." To overcome this evil, they provide an axle or shaft for a guide-roller so mounted as to be capable of movement away from or towards the centre of the holder, in order to maintain a uniform distance between the ends of the axles or shafts and the sheeting of the holder.

This result may be attained in a variety of ways, two of which are shown.

The holder sheeting has a rail plate thereon, to which is attached a spiral guide rail C. D is a guide-rail roller connected to the roller axle or shaft E by the set-screw H—thus enabling lateral movement of the sheeting and rail to be directly transmitted to the roller axle. A nut or stop G at the outer end of the axle or shaft, limits the movement of the latter towards the centre of the holder.



Dempster's Spiral Guides for Gasholders.

In fig. 2, the roller shaft E is freely mounted within the carriage I, so as to be capable of movement in the direction of its axis, in addition to that of rotation. The carriage also is shown mounted in connection with the tank side L only.

In some cases it is desirable for the axle E to be incapable of rotation; the roller D being arranged to revolve upon the axle. For this purpose a loose collar may be pinned to the axle between the roller and the carriage, or equivalent abutment means provided; sufficient "clearance" being allowed for the requisite movement of the axle to take place.

As an alternative arrangement, the roller-carriage I may be capable of movement away from or towards the centre of the holder, in the direction of a radial line of the holder, by sliding upon a base-plate suitably formed for the purpose. But in fig. 3, one method for enabling a roller axle or shaft to be moved away from or towards the centre of the holder in a direction other than radial is shown—that is to say, the roller-carriage I, carrying an axle or shaft E, is capable of movement in guides K in a suitably oblique direction relatively to the direction of the radial line or axis A B of the axle or shaft previous to such movement. The guides are here assumed to be formed in a suitable base plate.

APPLICATIONS FOR LETTERS PATENT.

27,085.—RANDALL, H. J., "Tool adjustable to all sizes for facing the seating of valves without removal from their fixed position." Dec. 14.

27,159-60.—C. ISLER AND CO., LTD., and BROADHURST, H. F., "Air-lift liquid raising apparatus." Dec. 14.

27,170.—WICKETT, J. H., "Gas heating stove." Dec. 15.

27,173.—CLARKE, D., "Reflectors, glasses, globes, and cylinders for inverted burners." Dec. 15.

27,198.—MAUD, J. W., "Inverted burners." Dec. 15.

27,214.—WHITEHOUSE, E., and HAWTHORNE, H. S., "Atmospheric burners." Dec. 15.

27,219.—WHEATLEY, J. & D., and AYNSLEY, J., "Hot-ccke extinguishing apparatus." Dec. 15.

27,241.—OSTERMANN, F. K., "Rotary engine or pump." Dec. 15.

27,245.—NORMA COMPAGNIE G. M. B. H., and KIRNER, J., "Pyrometers." Dec. 15.

27,268.—GLOVER, W. T., and METERS, LTD., "Gas-meters." Dec. 15.

27,290.—ROSE, A., and BELLAMY, W., "Inverted burner." Dec. 15.

27,305.—JERVIS, J. J., "Charging gas-retorts." Dec. 16.

27,335.—FRIED. KRUPP AKT.-GES., "Steam or gas turbines." Dec. 16.

27,397.—PASS, E., and PEART, E., "Branch service-pipes from main supply-pipes." Dec. 17.

27,423.—HELPS, G., "Gas lamps and burners." Dec. 17.

27,446.—CHIPPERFIELD LAMP SYNDICATE, LTD., and FLETCHER, E., "Governing the pressure of gas." Dec. 17.

27,458.—HOARE, G. C., and ACKLAND, T., "Stopcocks." Dec. 17.

27,521.—SUTCLIFFE H., "Anti-vibrator." Dec. 18.

27,522.—JEFFERY, F. W., "Supports for incandescent burners." Dec. 18.

27,557.—BROESE, O., "Cleaning device for heating nozzles and burner slots of gas apparatus." Dec. 18.

27,575.—SUNDERLAND FORGE AND ENGINEERING COMPANY, LTD., and BLAIR, W., "Governors." Dec. 18.

27,593.—BESNARD, H., MARIS, G., and ANTOINE, M., "Acetylene generators." Dec. 18.

27,628.—WINPENNY, A. R., "Rotary engines, pumps, blowers, and exhausters." Dec. 19.

27,625.—LANHAM, W., "Automatic throttle or cut-off valve for gas-stoves." Dec. 19.

27,630.—TRENOW, E. H. R., "Petrol gas." Dec. 19.

27,641.—RAIGOR, H., "Anti-vibrator." Dec. 19.

27,651.—KOHOUSEK, J., "Boiling-plates for stoves." Dec. 19.

Increased Water Storage for Heywood.—A new reservoir, which has been constructed for the Heywood and Middleton Water Board, was recently opened at Ashworth Moor. It has taken ten years to construct, has cost £250,000, and holds 400 million gallons of water.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Livesey Memorial.

SIR,—I am sorry to disagree with Mr. Charles Carpenter in his views, as stated in this week's "JOURNAL."

Considering what Sir George did for gas lighting, and his position in the gas world, I think we are bound to pay every possible regard to the kind of memorial he would have liked; and I feel sure the decision come to by the meeting held on the 10th inst. would not be his choice. The Leeds Professorship, in itself, is a step in the right direction; but it should not be made the memorial, as suggested by Mr. Carpenter.

If Sir George could now speak, I believe (and am well supported in this opinion) that he would select a memorial to be placed in the midst of where his life's work was carried out; and that, of necessity, would be in London. If elsewhere, disappointment would be strong and keen, where at least it ought not to exist.

The letter of Mr. J. H. Cornish is worth considering.

E. S. PIKE.

Reigate, Dec. 23, 1908.

SIR,—I thoroughly agree with Mr. Carpenter as to the form of the Livesey memorial.

The last letter I had from the late Sir George Livesey on the matter of the Leeds Professorship, dated Nov. 22, 1907, is a clear indication of his feeling. A short extract will explain itself: "We shall get the needful amount . . . and ought to have done so long ago. . . . But I do not like begging; and it ought not to be necessary to do so in such a cause."

East Hull Gas Company, Dec. 24, 1908. JOHN HOLLIDAY.

LEGAL INTELLIGENCE.

A MAGISTRATE CHARGED WITH CRIMINAL LIBEL.

Mr. S. J. H. Willey and the Chairman of Messrs. Willey and Co.

At the Croydon Borough Police Court last Thursday—before Alderman N. Page (Chairman), Mr. J. W. Gardiner, and Mr. C. Hussey—Frederick Templer Depree, J.P., of Swiss Cottage, Exeter, Chairman of Messrs. Willey and Co., Limited, was summoned by Sidney James Henry William Willey, of Corra Linn, Dingwall Road, Croydon, on a charge of criminal libel.

Mr. CURTIS BENNETT, jun., appeared in support of the summons; Mr. A. NEILSON defended.

Mr. BENNETT said the summons was taken out under section 5 of the Libel Act, 1843. The complainant was formerly in the service of Messrs. Willey and Co., as London Manager and also as traveller; and the defendant was the Chairman of the Board. On the 13th of December, Mr. Willey received a letter signed by Mr. Depree, and in his handwriting; and when the Magistrates had looked at it, he (Counsel) thought they would have no doubt that it was a libel.

The letter was handed to the Magistrates, but was not read aloud.

Complainant was called, and spoke to the receipt of the letter, which, he said, dismissed him from his post.

Mr. NEILSON submitted that no proof had been given that the letter was anything more than one dismissing the complainant. There was no evidence of malice; and, on the face of it, it was a privileged document. Counsel quoted a ruling of Lord Chief Justice Coleridge to the effect that criminal proceedings for libel ought not to be taken unless the libel was calculated to disturb the peace of the community. The letter was so little calculated to do this that his learned friend had not thought fit to read it.

Mr. BENNETT: For that very reason.

Mr. NEILSON contended that the letter was nothing more than the dismissal of a servant by a master.

Mr. BENNETT replied that it was not necessary for him to prove malice; and if Mr. Neilson's contention was that the letter was a privileged one, it was for him to prove it. The question of privilege was one for a Judge and not for that Court. A third party was mentioned.

The Magistrates having deliberated in private,

The CHAIRMAN said they had carefully considered the arguments and also the letter, which they thought was, on the face of it, libellous, and calculated to provoke a breach of the peace, and they had, therefore, no alternative but to send the case for trial.

Mr. Depree entered into recognizances to appear at the Assizes.

Bolton Gas Undertaking Statistics.—With the addition of several new areas, the Gas Committee of the Bolton Corporation have now to provide for 45,406 consumers, in addition to 5325 public lamps within the borough; the total sale of gas per day being 5,939,000 cubic feet. The make of gas per annum is 1,000,020,000 cubic feet; and the coal carbonized in the twelve months is 97,404 tons. The total length of mains is now 280 miles; and the capital outstanding on the department is £646,784—the total income on the year being £156,593.

Gas on the Cheap.—The small return of coppers from a penny-in-the-slot gas-meter at the house of George Alfred Rice, of Hope Square, Ardwick, Manchester, gave rise to suspicion in the minds of those in charge at the gas offices of the Corporation. A surprise visit paid by the Corporation inspectors provided the explanation. The fittings of the meter had been removed; and by the use of an india-rubber pipe from the main, the gas consumed had not been accounted for. These facts were laid before the Magistrates last Thursday, when Rice was fined 21s. and costs, or a month's imprisonment in default.

MISCELLANEOUS NEWS.

CO-PARTNERSHIP IN SOUTH LONDON.

Mr. Charles Carpenter's Message.

The January number of the "South Metropolitan Gas Company's Co-Partnership Journal" embraces several features which will be highly prized by its readers. In the first place, there is given with it an almanac, in the centre of which is appropriately placed an excellent portrait of the late Sir George Livesey, the founder of the scheme; and underneath the picture are the words: "To live in hearts we leave behind is not to die." The frontispiece to the "Journal" itself is an equally good photograph of the new Chairman of the Company, Mr. Charles Carpenter, whose address to the co-partners occupies the place of honour among the literary matter. The address is in the following terms.

The hand which penned so many helpful messages to us has laid down the pen and passed to its eternal rest since the loving words were written by it in welcome of this now waning year. Our beloved friend has gone from our midst, and his kindly voice will inspire us no longer; but the great work he achieved will endure to be our guide and to those who follow us. The world is the better for his having lived; let us endeavour that this may be true of us, too, when our time comes to quit it.

The New Year is popularly regarded as a convenient time for the making of new resolutions; but perhaps we may be able to put to better use the new leaf we are so soon to turn over, if we spend a little thought in looking backwards, and from the past seek to derive lessons for the future. One of the most frequently used words in connection with the employees has come to be "co-partner." In days gone by, a man was spoken of as a good workman or as a good timekeeper; and not unfrequently only one of these descriptions could be properly applied to the person designated. It sometimes happened, moreover, that a workman, though skilled and keeping his regular hours, was not the most industrious, or had the habit of laying aside his tools, no matter the job on which he was engaged, before the bell was cold. Nowadays we have at hand an expression of much wider meaning—wide enough, indeed, to include within it all other characterizations. We have come to speak of a man as being a "good co-partner," and, by placing him in that category, saying the most that is possible of him from the Company's point of view.

While co-partnership has been making steadier and more industrious workmen, their lot has also become one of greater happiness. The German philosopher Nietzsche described happiness as "adaptability to one's environment." We may extend this terse definition by saying, "So order your lives as to make the most of all that is within your reach, without wasting your substance in seeking or sighing for what is or seems unattainable." Kipling looked at happiness in another way, and expressed it as having plenty of work to do and the health to do it. This, no doubt, will appeal to all co-partners who know there is even a pleasure in the tiredness following a well-spent day. Neither writer, let it be observed, associates happiness with the possession of "plenty of money." Many men have been personally known to me who have brought up a fair-sized family on 27s. a week—men who were happy at their work, whose homes were clean, and whose children were tidy. I gained more intimate knowledge of a carefully living family on a somewhat higher scale; the breadwinner with whom I lodged earning 40s. weekly. His thrifty wife was as bright as a fresh, rosy-cheeked apple, the children were well brought up, and there was always a bit of money put by for a rainy day or a doctor's bill.

Now the payment of a bonus on wages is a part, but only a part, of the advantages derived by the employees from the co-partnership scheme. Something more has been brought about by it than the improved financial status of the workpeople, even though the co-partners' stock-holding in the Company now amounts to £298,866. This was admirably expressed by Mr. Beard at the recent shareholders' meeting, when he referred to the change which had come over the tone of the men as the result of co-partnership during the last nearly twenty years. The conditions under which the worker follows his trade are very different from what they were. He takes more pleasure in his work, and feels an interest in it, knowing he has a stake in the undertaking by which it is provided, and that by agreements he holds it on a much more certain tenure than was possible under a system of hourly, daily, or even weekly notices. A spirit of fellowship, too, has sprung up which is a great sweetener of toil; and no matter where or what is the sphere of a man's employment with the Company, he has learned to rely upon being treated fairly and considerately.

I have said that the payment of a bonus is only a part of the general scheme of co-partnership. There have been occasions when it has acted harmfully, as, for instance, with men who have thrown up regular employment at the full rate of wages in order to draw out their accumulated bonuses. Co-partners will not have much sympathy with the generality of such cases. Another type of thriftlessness came before me the other day in the shape of a young man, unmarried, and lodging with his parents, and who, though earning £2 a week, was in debt to the tune of £40. He certainly had not "adapted himself to his environment;" and I can as certainly say he had not achieved happiness. Now, it is because I do not regard the bonus as the all-in-all of co-partnership that I do earnestly urge all co-partners to look upon it not as something set aside for a rainy day (this should be provided for from wages); but as a special reserve for a real storm of trouble. In the great majority of cases this will not arise; when it does, the untouched bonus will be a great help to weather it.

Now for a personal matter. It is rather more than ten years ago since I came to the Old Kent Road works. Those years have been the happiest of my business life; for they brought me into intimate contact with our late Chairman, who, I am proud to say, honoured me with his friendship and his confidence. As an engineer I should have

been content and happy to remain; for I might indeed have looked upon my appointment as an election by the staff and workmen, so kindly disposed was everyone towards me. But other calls have since been made upon me, by the shareholders to the directorate, and by the directorate to the chairmanship. I accepted both honours, feeling sure that I should have the support of my colleagues and every co-partner in my endeavour to occupy the position in a manner worthy of its importance. From the time when, as a boy, I first entered the Company's service, I have had nothing but kindness and help from all with whom I worked or was associated—thus I became Chief Engineer. Still more now do I need the support and goodwill of every man in the Company if the traditions handed down to us are to be maintained. I feel I may rely upon this help being given, that we may overcome the effects of the mournful shadow which was in 1908 cast over us; and in expressing this faith I sincerely hope that all co-partners may enjoy in 1909 "A Happier New Year."

CO-PARTNERSHIP AT WREXHAM.

When presiding at the meeting of the Wrexham Gas Company last March, Mr. J. Oswell Bury stated that the Directors had under consideration the question of adopting a profit-sharing scheme for the joint benefit of the employees and the Company, similar to that in force in many other places. When complete, the scheme would be submitted for their approval. He was strongly of opinion that profit-sharing with the employees was a satisfactory move in the direction of bridging-over the difficulties existing between Capital and Labour, and creating a better feeling between employers and employed, by giving the workmen an interest in the Company's business; and that the Company would benefit by the greater care which he felt certain would be exercised by the men in the discharge of their duties to secure the best possible results for the Company.

A scheme has since been prepared, providing for a system of profit-sharing by all the employees and members of the staff, by means of a bonus on wages earned (excluding overtime) in each year, which will be calculated at so much per cent. on every penny below a fixed average price at which the Company may find themselves justified in supplying gas to the consumers. The bonus earned will be retained by the Company until it reaches a figure large enough to make the employee a shareholder in the Company, when stock will be purchased for him accordingly. After an employee becomes a shareholder, it is anticipated that he will be anxious that further bonuses shall go towards augmenting his holding in the Company; but should he decide otherwise, he will be entitled to withdraw unconditionally the money represented by them. In addition to the bonuses forming the nucleus of a stock-purchasing fund, the employee may deposit with the Company any share of his earnings or savings which he may elect to do, for the purpose of adding to the money available for the purchase of stock; and upon money so deposited he will be allowed interest at the rate of 3 per cent. until the cash is made use of for the purchase of stock, which will then carry a 5 per cent. dividend. The scheme will be worked by a Committee of Management consisting of two Directors, two co-partners nominated annually by the Directors, and four representatives of the co-partners.

Copies of the scheme having been circulated among the employees, a joint meeting of the Directors and elected representatives of the men took place a few days ago to consider the matter. Mr. Oswell Bury then explained the proposal, and said that in the opinion of the Directors the scheme would prove a great success, both in the interests of the Company, and from the point of view of the employees. If through any unforseen circumstance, such as a big increase in the price of coal, the Company should be compelled to increase the price of gas, this might mean a diminution in the amount of bonus divided. In such an event he was confident the employees would loyally accept the reduction without demur, and in the same spirit as they would receive any additional bonus following a reduced price of gas.

Mr. Joseph Lloyd said the men had met and thoroughly approved of the scheme, and were wishful of expressing to the Directors their grateful thanks for their kindness in proposing its adoption. He felt certain it would work exceedingly well, and have the effect of making everybody concerned do his utmost in the interests of the Company. Mr. J. C. Williams also thanked the Directors for the office staff.

Mr. Oswell Bury said that, well as the whole of the staff had served the Company in the past, he felt sure that they would all be able in their daily work to show in some tangible manner their appreciation of the arrangement.

The scheme was thereupon unanimously approved; and it was decided to make it retrospective as from Jan. 1 last.

PUBLIC LIGHTING OF IPSWICH.

The Shadow of Electricity.

At a Special Meeting of the Ipswich Town Council last Wednesday, the Paving and Lighting Committee reported that the existing contract between the Corporation and the Ipswich Gas Company for lighting the public streets would expire on the 31st inst. In October last, the Committee called the Company's attention to this fact, and asked to be informed upon what terms the Company would be willing to enter into a new contract. To this the Engineer and Secretary (Mr. J. T. Jolliffe) replied that he was instructed by the Directors to inform the Committee that they were prepared to enter into a fresh contract to light the whole of the public lamps in the borough for a period of three or more years, at a reduction of 3s. per lamp per annum off the price now charged for the lamps fitted with Welsbach "C" burners, and 5s. per lamp per annum off the price now charged for the lamps fitted with No. 7 Kern burners. They regretted that they were unable to make any reduction off the 38 lamps fixed in the courts and alleys of the town, which were fitted with flat-flame burners. The total number of lighting hours would remain the same as at present—3686½. He pointed out that the effect of this reduction would be a saving to the Corporation of about £260 per annum. To this, the Town Clerk (Mr. W. Bantoft) replied that the Committee were not prepared to enter into a contract for lighting the public lamps for a period of three years, but would have the 38 flat-flame burners in courts and alleys replaced by Welsbach "C" burners, and would recommend the Council to enter into a contract for lighting the whole of the public lamps in the borough for one year from Dec. 31, at reductions of 3s. per lamp per annum off the present price for Welsbach "C" burners, and 5s. per lamp per annum off for No. 7 Kern burners. On the 14th inst., Mr. Jolliffe informed the Committee that the price quoted for a new contract for lighting the public lamps was a specially reduced rate, based upon a contract for three years, and the Directors were unwilling to enter into a contract for lighting the public lamps for one year only at the prices quoted. Under these circumstances, having regard to the early termination of the existing contract, the Committee asked that they might be empowered to make such arrangements for lighting the public streets as they might think desirable, for a term not exceeding two years from the 31st inst.

Mr. H. W. Raffe, the Chairman of the Committee, in moving the adoption of the Committee's recommendation, said it was a long time since they had had an agreement with the Gas Company for three years; and he was at a loss to understand why the Company should ask for a contract for this period at the present time, unless they wanted to squeeze the Corporation. The Committee had been prepared to entertain the idea of street lighting by electricity, when the Electric Lighting Committee should offer them as good terms as the Gas Company. Until that time, the Committee were not justified in recommending the Council to alter their method of lighting. They had had one or two suggestions from the Electric Lighting Committee for lighting the borough. When the first offer was made, they did not know what streets would come in between the areas suggested for partial lighting by electricity; and, therefore, the Paving and Lighting Committee asked to have a list made out, and a plan of the town, showing where the proposed electric lighting would be. There were at present 1664 gas-lamps on standards in the borough. Of these, 1134 belonged to the Sanitary Authority, and 530 to the Company. The proposal by the Electric Light Committee was that they should use the lamp-columns belonging to the Sanitary Authority for electric lighting purposes. The area they proposed to light by electricity would require 355 lanterns of a candle power of 32,350, the charge for which would be £1348. The Gas Company would light the same area with the same number of lights, and the same candle power, for £1425. If they had agreed to the Committee's suggestion for a contract for twelve months, this amount would have been reduced by £65—namely, to £1360. The Paving and Lighting Committee wanted the Electric Lighting Committee to guarantee the same quality of light; and they had done so. The question was whether or not the Council should now enter into an agreement with the Gas Company for three years, or whether they would leave it in the hands of the Paving and Lighting Committee to settle with the Gas Company. They might come to terms with them for a reduction on a two years' contract. The Gas Company might, however, say that the Council were proposing to light such streets as they could by electricity, and would only give them a chance of lighting those streets which they could not light themselves. That was so. The Council could not light with electricity streets where they had no cables put in.

Mr. E. C. Ransome, the Chairman of the Electricity Committee, said no doubt the lighting of the streets by electricity would materially help them to reduce the cost of their whole output, and, therefore, to increase their profit—or, perhaps he should say, to diminish their loss. Their position was that they were only recently able to quote a favourable price for electric lighting, due to the new metallic lamps; and the time was too short now to allow them to start lighting the streets for the coming year. He thought, however, the Council should give the Electric Lighting Committee the order as soon as possible to light all streets where the mains were already down.

After various other speakers had addressed the Council, the report of the Committee was adopted.

PUBLIC LIGHTING AT PLYMOUTH.

There is some prospect, though perhaps only a slight one, that experiments may be carried out at Plymouth with a view to proving the respective advantages of gas and electricity for street-lighting purposes. At the last meeting of the Electricity Committee, which is also the Street Lighting Committee, they had under consideration the question of whether any means could be advantageously adopted to demonstrate the effectiveness of electric light for street illumination by the introduction of special arc lamps at prominent points in the centre of the town. This is at present lighted by arc lamps, but certainly not effectively; while other streets are lighted by gas. The Committee instructed the Electricity Committee to submit a report on the subject of the erection of special arc lamps. On the announcement of this fact in the Press, Mr. H. B. Heath, the Secretary of the Plymouth and Stonehouse Gas Company, at once wrote to the Town Clerk, applying, on behalf of the Company, for permission to demonstrate what can be done with gas in the way of public lighting, in order that the Corporation may have the fullest information before them as to the lighting which offers the greatest efficiency with economy. The Company were willing to defray the expense of a demonstration, he said, in the belief that friendly competition must be of advantage to the ratepayers. Mr. Heath added: "We are justified in making this application, inasmuch as all ratepayers in Plymouth who are gas consumers are partners in our undertaking. By our Act of Parliament, approximately nine-tenths of the profits made by the Company, after paying 5 per cent. to the shareholders, go to consumers. Consequently, if by the substitution of electric light for gas in the public streets of Plymouth a loss of net revenue is made by this Company to the extent of £100 or £500, the ratepayers who are gas consumers will have to pay about nine-tenths of that loss in the gas bills. If our application be granted, we suggest

that the spots in the town selected to be illuminated by electricity and gas respectively be agreed upon by the Electrical Engineer and our Engineer, and that some impartial expert or persons be instructed to investigate the respective costs to the ratepayers by each method of lighting." There the matter rests at present; and probably nothing more will be done until the Committee meet again next year.

MUNICIPAL TRADING IN THE RHONDDA.

A lengthy letter appeared in the "Western Mail" for the 19th inst., over the *nom de plume* of "Statistics," in which the writer took for his text the losses on the Rhondda Gas and Water Works for the year ended March 31 last—£2285 on the gas-works, and £2833 on the water-works, or a total deficit for the twelve months of £5118.

The object of the letter was to show that, after ten years' possession of the works by the Council, the results are an "absolute contradiction of the glowing pictures put before the ratepayers twelve years ago, when the Council asked their sanction to obtain parliamentary powers to purchase the property of the Ystrad Gas and Water Company." The following comparison is given of the working of the gas concern under the Council and the Company—the figures relating to the former being from the latest Board of Trade returns; while those of the Company refer to their final year's working.

	Council. 1906-7.		Company. 1896.
Capital expended	£215,331 0 6	..	£59,277 0 0
Receipts	£33,800 0 0	..	£12,925 0 0
Expenditure	23,311 0 0	..	6,703 0 0
Gross profit	£10,489 0 0	..	£6,222 0 0
Interest on loans and payment to sinking fund	£12,460 0 0		
Deduct gross profit	10,489 0 0		
Deficiency	£1,971 0 0		
Percentage of gross profit on total capital expended	£4 17 5	..	£10 9 11
Coal carbonized, tons	18,541	..	6,945
Gas made, cubic feet	181,696,700	..	72,656,000
Gas sold, cubic feet	131,563,600	..	63,131,000
Gas lost by leakage	50,133,100	..	9,525,000
Percentage of gas lost by leakage on total make	27·5	..	13·1
Gas made per ton, cubic feet	9,799	..	10,482
Length of gas-mains, miles	50	..	26
Gas sold per mile, cubic feet	2,631,000	..	2,428,000
Gas lost in leakages per mile of main, cubic feet	1,022,000	..	365,000
Number of consumers per mile of main	166	..	59
Gas sold per consumer, cu. ft.	15,780	..	41,208
Gross profit per 1000 cubic feet sold	1s. 7d.	..	1s. 11d.
Price charged to consumers per 1000 cubic feet	4s. 3d.	..	4s. 3d.

From this, the letter goes on, it will be seen that it is not possible to point out one item that favours municipal control, except that more gas is sold, chiefly in consequence of the increase of the district, and not because of any reduction in price, as such has not taken place. On the contrary, the consumers have had the price of gas raised to them for the past ten years, and probably for the next twenty years, in having to pay by means of the general district rate such sums as £2285 per annum, or about 4d. per 1000 cubic feet.

In conclusion, the writer says it is not possible to compare the working of the Water Department in the same manner as the gas, for the reason that since being in possession of the works the Council have applied for and received parliamentary power to raise the water-rates to figures 20 to 25 per cent. more than those charged by the Company. The fact of the Council having received this power, undoubtedly enabled the Pontypridd Water Company this year to get similar powers of charge in their district of supply, part of which is in the area of the Rhondda Council; and thus the municipalizing of one portion of the Rhondda brought about increased charges in the whole of it. The profit on the water undertaking for the last year of the Company (1896) was £4306, as against the Council's above-mentioned loss of £2833.

QUALITY OF MANCHESTER GAS.

Alderman Gibson's Reply to Critics.—A Maintenance System Promised.

Complaints as to the quality of the gas supplied by the Manchester Corporation continue to be made through the local Press; and they have brought a vigorous reply from Alderman Gibson, the Chairman of the Gas Committee.

Alderman Gibson does not deny that many complaints have been received of late, but says that on investigation they have been found not to be due to bad gas, but to defective fittings, globes, burners, &c.; and on these being put in proper condition, the light always became satisfactory. In support of this contention, he shows that, for the last financial year, of the 21,339 complaints received (out of over 165,000 consumers), 9871 were found on examination to arise from defective meters, 5457 from defective fittings, 5686 from stoppage in pipes, 193 from escapes of gas, and 133 from lamp damage. The gas supplied to Manchester is of 17·5-candle power; and every hour the works chemist makes a test, the results of which are reported to the Gas Committee. In addition, the gas is periodically tested by Messrs. Alexander Wright and Co., whose representatives make surprise visits to the works for the purpose. Messrs. Wright's report of tests carried out in November, on four different days, states that the illuminating power was as follows: Bradford Road, 18·01 and 17·81 candles; Rochdale Road, 17·64 candles (morning and afternoon); Gaythorn, 17·45 and 17·84 candles; and Droylsden, 17·06 and 17·10 candles. These were tests made independent of those of the works chemist. When different kinds of coal are being carbonized, some variation, Alderman Gibson says, may perhaps arise; but, if so, it is infinitesimal.

Alderman Gibson protests strongly against the assertion made by one critic that "the poor are the chief sufferers," and also against the "ridiculous suggestion" that "it is questionable if those who use penny-in-the-slot meters get what they bargain for." Singularly enough, he adds, none of the present complaints are from poor people—they keep their fittings in good order. He holds that the incandescent light, instead of being expensive for the poor, is for them far cheaper than flat-flame burners, in addition to which they have a more brilliant and a purer light. The incandescent system gives twice the illumination at half the cost, burning only 3½ cubic feet of gas per hour, compared with 7 feet. Mantles are not, he points out, expensive, if properly looked after. In his own case, he has a man who examines his mantles and fittings every month; and though he lives in a large house, the average cost in new mantles is but 7½d. each visit. It is the intention of the Manchester Corporation, Alderman Gibson says, to institute a systematic method of inspection. A special staff of men will be employed to periodically visit houses, supply mantles, and examine and advise as to fittings, &c.

Replying to a statement that Manchester gas was not only poisonous, but escapes undetected, Alderman Gibson says: "Gas as supplied in Manchester is a mixture of coal gas with 15 per cent. of carburetted water gas, which all engineers agree is the best form of illuminant. Carburetted water gas is just as pungent as coal gas, and gives the same notice of its presence. If an escape of coal gas goes undetected, it will kill. Carburetted gas will kill quicker, just in the same way as (say) 25 drops of prussic acid will kill quicker than 20. But that is no argument why prussic acid, or dynamite, or any other destructive substance, should not be used at all. In Boston, a Royal Commission has reported that there is no more danger from carburetted water gas than any other. The moral of every householder should be 'Look to your fittings.'"

PROPOSED ARC LIGHTING AT FINCHLEY.

Ratepayers' Candid Opinions.

The Finchley Urban District Council possess a Highways Committee and an electric light undertaking; hence we have a proposal by the former to (in the words of the notice calling a special meeting of the West Finchley Ratepayers' Association last week) "commit the ratepayers to a great increase in the cost of street lighting by lighting Ballards Lane and a portion of Great North Road with electric arc lamps." About eighty ratepayers attended the meeting, which was presided over by Mr. C. H. Chambers; and from the general tone of the speeches made, it is clear the suggestion of the Committee is viewed with a considerable amount of misgiving on the part of those who have to "pay the piper."

Mr. Syrett said it would seem they were purposing to adopt a scheme that had been tried in many places. They need go no further than the City of London, where a good deal of arc lighting had been taken away, and incandescent gas substituted. He thought they could take it that the officials of the City of London were as good and intelligent as any in the country; and their opinions and actions were worth considering. The Electricity Committee were to charge the Highways Committee 1½d. per unit for current; but, according to the Electricity Committee's own figures given some time ago, the actual cost to the Electricity Department was 1·76d. per unit, and he did not see why the department should be saddled with a loss of 0·26d. per unit for the benefit of the Highways Committee. He believed the Highways Committee were to attend to the upkeep; but he could not make out where their responsibility commenced and ended. He was at one with the Council that better light was needed; but they wanted it all over the place. If they had large glares over 4000 yards of road, the private streets must suffer by comparison. Where it seemed bad now, it would appear much worse in the future. Again, with the extra strain on the undertaking, he was afraid that private street lighting would suffer. Further, it was proposed to put the arc lamps on the top of the present poles; and he was informed that in this position they would lose 50 per cent. of road surface lighting power. They would be lighting the heavens instead of the earth. There had been talk about centre-pole dangers; and this danger would be increased 50 per cent. by the alternate glare and comparative darkness. They wanted an estimate of the comparative cost of gas. He had discussed the matter with an engineer of a well-known suburban district, where they had an electrical undertaking; and this engineer told him that, from experience, he found the only effective method of street lighting for the moment was high-pressure gas—and it was cheaper.

Mr. Hollis quoted an extract from the "Electrician" to the effect that high-pressure gas lighting for streets costs four times as much as arc lighting; and then Councillor Rabbidge said he proposed to consider the electricity undertaking exactly as any other concern. He would not pledge himself either to electricity or gas; but he wanted to know the cost of both. They were now paying more for their street lighting—something like 10s. a lamp—than they need pay in the open market. He did not believe in deceiving themselves by saying the undertaking paid when they were actually paying more for street lighting than they need do. Sir W. H. Preece, who reported on the electricity undertaking, told them that the work of street lighting was carried on at a loss to the Electricity Department; and if this was so, the loss would be increased. The streets should be better lighted; but he would steadily refuse to vote for any scheme until the cost of high-pressure gas lighting was before the Council. Councillor Royston said that Councillor Rabbidge's statement that they were paying 10s. a lamp more than they need do for street lighting was entirely untrue.

Councillor Rabbidge: I declare it is true. The offer was made by the Gas Company.

Mr. Wells remarked that all were agreed upon one point—the necessity for an improvement in the street lighting. Reference had been made to the City of London. He was a member of the Corporation, and of the Streets Committee; and he could say that the consensus of opinion was that they should exchange arc lighting for incandescent gas. It was not their intention to use high-pressure gas lighting; but their idea was a better and a cheaper light. With regard to Finchley, if the cost of current was 1·76d. per unit, and it was sold to the Highways Committee for 1·5d.—that was, transferring it from one pocket to the other—the price they were paying was 1·76d., not 1·5d. But the cost was probably under-rated; and not only were they going to lose ¼d. a unit, but the number of units would be greater than at the present time. He was quite sure that the Council would pay due consideration to any resolution the Association passed. It was admitted that the Highways Committee had not considered an alternative gas scheme; and this was what they (the ratepayers) wanted. If, when the question of gas was considered, it was found that the extra cost of arc lighting was small, then he would say: "Give it to the electrical undertaking." But if the difference was substantial, he thought they ought to have gas. The increased cost of the Council's scheme was something like 1d. in the pound. In conclusion he moved—"That this meeting of the West Finchley Ratepayers' Association respectfully urge the Council, before deciding on the proposed scheme, to consider the question of whether gas could be introduced."

Dr. Godfrey moved an amendment to the effect that the following words should be added: "And that, before finally deciding, the Council will afford the ratepayers an opportunity of again considering the matter." Mr. Wells accepted the addition; and the combined resolution was carried unanimously.

That the North Middlesex Gas Company have no intention of taking the matter "lying down" is evidenced from the fact that, on the publication of the Committee's proposal, Mr. E. L. Burton, the Secretary of the Company, at once wrote to the Clerk to the Council (Mr. E. H. Lister), pointing out that the decision to embark upon a costly scheme of street lighting without obtaining competitive tenders for other sources was a most unusual method of procedure, "entirely opposed to the best interests of the ratepayers, and at complete variance with the policy laid down by the Local Government Board." The letter then continued: "It must be agreed on all hands that the existing scheme of lighting is inadequate to the needs of the community. That this can be remedied by installing a system of incandescent gas lighting affording most efficient results at a low cost for upkeep, and with comparatively small capital outlay, is a fact well known to the members of your Council. My Company are prepared to go fully into the matter, and to again submit a series of offers for street lighting. If the saving of public money is a consideration to your Council, the more efficient and more economical system of street lighting by incandescent gas—almost universally coming into use—must appeal to them."

AMERICAN GAS-WORKS STATISTICS.

In the last number of the "JOURNAL" (p. 847), we gave some figures relating to the production of gas in the United States, furnished by an advance chapter of the "Mineral Resources of the United States for 1907," prepared by Mr. E. W. Parker, of the United States Geological Survey. We are enabled to-day to give additional particulars.

The statistics presented in this chapter have been compiled in response to a demand from producers of coke and gas; and while possibly they are not properly included in a report on mineral resources, which is supposed to be limited to the discussion of mineral production in the first marketable condition of the mineral products, the information is of interest in connection with, and as supplemental to, the reports on the production of coal and the manufacture of coke.

The first volume of "Mineral Resources," which contained a report on the production of gas, coke, tar, and ammonia at gas-works and in retort-ovens, was that for 1898, and was a special report prepared by Dr. William B. Phillips. Reports which followed the general lines of the one prepared by him were published in the volumes for 1902, 1903, 1904, and 1905. On account of pressure of other work, no report on these subjects was published in the volume for 1906. The report for 1905 and the present chapter include, in addition to the statistics of the production of gas, coke, tar, and ammonia at gas-works and in retort-ovens, statements of the production of gas and tar at water-gas works. At some gas-works, oil is used for enriching purposes, and in a few cases oil gas is made. When oil is used for enriching water gas or coal gas, the entire product is considered as water gas or coal gas.

In the preparation of the report for 1898, returns were received from 433 companies manufacturing gas from coal. This report did not include the production of gas, tar, and ammonia from the 520 bye-product recovery coke-ovens that were in operation that year. The statistics for 1902 and succeeding years included the production from both gas-works and bye-product coke-oven plants, and those for 1905 and 1907, as already noted, contain statements of the production of gas and tar from water-gas works.

In 1902, there were 533 companies reporting—an increase of 100 from 1898; and the reports included returns from 1663 bye-product ovens. In 1903, reports were received from 528 coal-gas companies; and the statistics included the production from 1956 bye-product ovens. In 1904, the statistics included returns from 534 coal-gas companies and the production from 2910 bye-product ovens. In 1905, the coal-gas production was made up from returns received from 529 companies and 2998 bye-product ovens. The statistics for 1907 have been compiled from reports made by 516 companies and 3892 bye-product ovens. The decrease in the number of producing companies is due partly to consolidations effected during the last two years, and partly to the changing of some works from coal-gas to water-gas. It is probable also that the increased use of electricity for lighting purposes has caused the shutting-down of gas-works in comparatively small towns. Notwithstanding the decrease in the number of coal-gas companies reporting, the production of coal gas reported in 1907 (exclusive of that lost or unaccounted for) was 54,819,685,000 cubic feet, against 40,454,000,000 cubic feet in 1905—indicating an increase of gas sold in two years of 35 per cent.

The statistics of water-gas production show an increase in the number of companies from 477 in 1905 to 520 in 1907; and the production (exclusive of that lost or unaccounted for) increased from 77,412 million cubic feet to 94,635 millions—a gain of something over 22 per cent. The coal gas lost or unaccounted for in 1907 was 3423 millions, or about 6 per cent. of the total production. The loss of water gas amounted to 7505 million cubic feet, or something over 7 per cent. of the production.

Of the coal gas sold in 1907, approximately 30,000 million cubic feet were for illuminating purposes, and something like 24,000 millions for fuel purposes. Of the water gas sold, approximately 72,000 million cubic feet were used for lighting, and 22,500 million cubic feet for fuel. It is impossible to secure exact information on this separation of the gas for illumination or for fuel, as in a great many cases the gas for the two purposes in household use is passed through the same meter, and no difference in price is made to the consumer. In selling gas for power purposes in large quantities, the case is different. The separation presented in this report is as correct as it is possible to make it.

Production.—As previously stated, the reports on the production of gas, coke, tar, and ammonia prior to 1905 did not include the operations of water-gas works; and for this reason the production of water gas in 1905 and 1907 will be considered separately. The following statistics include the operations of coal-gas works and bye-product recovery coke-ovens.

The total quantity of coal carbonized at coal-gas works and in bye-product ovens in 1907 was 11,490,661 short tons, of which 7,460,587 short tons, or 65 per cent., were consumed in bye-product oven plants, and 4,030,074 short tons, or 35 per cent., were used at gas-works. The quantity of coal carbonized in 1907 exceeded that used in 1905 by 3,302,849 short tons, or about 40 per cent.; the quantity of coal used in the latter year amounting to 8,187,812 tons, of which 4,628,981 tons, or 57 per cent., were coked in retort-ovens, and 3,558,831 tons, or 43 per cent., were carbonized in gas-retorts. In 1904, the quantity of coal used was almost equally divided between retort-ovens and gas-works; in 1903, the gas-works used 55 per cent., and the retort-ovens 45 per cent., of the total.

The total production in 1907 was 54,819,684,825 cubic feet of gas (not including that lost or wasted), 8,093,144 short tons of coke, 103,577,760 gallons of tar, 37,560,858 lbs. of anhydrous ammonia (the ammoniacal liquor production being reduced to its equivalent in ammonia), and 48,882,237 lbs. of ammonium sulphate. The corresponding figures for 1905 were 40,454,215,132 cubic feet of gas, 5,751,378 short tons of coke, 80,022,043 gallons of tar, 22,455,857 lbs. of anhydrous ammonia, and 38,663,682 lbs. of ammonium sulphate. The total value of these products in 1907 was $73,573,004, against $56,684,972 in 1905.

In the following table is presented a statement of the quantity of coal carbonized, and of gas, coke, and tar produced at gas-works and in bye-product ovens in 1905 and 1907. No separation by sources has been made of the ammonia produced. It should be distinctly understood that in giving the production of gas in bye-product ovens, only the "surplus" is considered—that is, the gas, over and above that used in the process, which is either sold or employed for other purposes than heating the ovens. As a usual thing, the gases which come off in the earlier stages of the process, and which are richer in illuminants, are those sold; while the leaner gases are used for heating the ovens. The quantity of gas sold at gas-works per ton of coal carbonized in 1907 was 8512 cubic feet, against 2750 cubic feet sold as surplus gas at retort-ovens per ton of coal.

Kind of Product.	Gas-Works.	Bye-Product Coke Plants.	Total.
1905.			
Coal coked . sh. tons.	3,558,831 ..	4,628,981 ..	8,187,812
Coal gas produced and sold . . . cub. ft.	30,722,278,832 ..	9,731,936,300 ..	40,454,215,132
Coke produced . sh. tons	2,289,030 ..	3,462,348 ..	5,751,378
Tar produced . galls.	43,642,189 ..	36,379,854 ..	80,022,043
1907.			
Coal coked . sh. tons	4,030,074 ..	7,460,587 ..	11,490,661
Coal gas produced and sold . . . cub. ft.	34,302,953,825 ..	20,516,731,000 ..	54,819,684,825
Coke produced . sh. tons	2,510,106 ..	5,583,038 ..	8,093,144
Tar produced . galls.	49,581,965 ..	53,995,795 ..	103,577,760

The total quantity and value of the gas, coke, tar, ammoniacal liquor (reduced to its equivalent in ammonia), and ammonium sulphate produced in 1905 and 1907 are shown in the following table. It will be observed that while the quantity of gas produced and sold in 1907 shows an increase of 35 per cent. over 1905, the value of this product increased only 11 per cent. On the other hand, while the quantity of coke produced increased 41 per cent., the value increased 61 per cent. Both of these opposite effects were due to the same cause—the larger proportionate production from bye-product ovens. The coke from the bye-product ovens is a much higher grade article than gas-works coke. It is used principally for blast-furnace and foundry purposes, for which retort coke is not adapted; and therefore it commands a better price. The average price per ton for all the coke from these sources in 1907 was $3·75, against $3·28 in 1905. The gas produced at bye-product ovens, however, is sold at much lower rates than that from gas-works—some of it as low as 9 c. or 10 c. per 1000 cubic feet; and the larger proportion of this product is chiefly responsible for the apparent decrease in the price of gas in 1907, as compared with 1905, though another factor—viz., the arbitrary reduction in prices by municipal authorities—had also some effect in this particular. The average price for all coal gas sold shows a decline from 81·4 c. in 1905 to 67 c. in 1907.

	1905.		1907.	
	Quantity.	Value.	Quantity.	Value.
Gas. . cub. ft.	40,454,215,132	$32,937,456 ..	54,819,684,825	$36,462,304
Coke . sh. tons	5,751,378	18,844,866 ..	8,093,144	30,332,644
Tar . . galls.	80,022,043	2,176,944 ..	103,577,760	2,651,527
Ammonia . lbs.	22,455,857	1,728,254 ..	37,560,858	2,601,057
Am. sulphate. lbs.	38,663,682	997,452 ..	48,882,237	1,525,472

*Production of Coal Gas.**—The total quantity of gas produced at coal-gas and bye-product coke works in 1907, as reported by the 516 companies who made returns to the Geological Survey, was 58,242,544,402 cubic feet. Of this product, 3,422,859,577 cubic feet were lost through leakage, fire, or otherwise, and reported as unaccounted for. The net product sold, therefore, amounted to 54,819,684,825 cubic feet, which was valued at $36,462,304, or an average of 67 c. per 1000 cubic feet. In 1905, the total quantity of gas sold was 40,454,215,132 cubic feet, valued at $32,937,456—an average of 81·4 c. per 1000 cubic feet; so that while the quantity of gas sold increased 14,365,469,693 cubic feet, or 35 per cent., from 1905 to 1907, the value increased only $3,524,848, or 11 per cent., and the average price per 1000 cubic feet showed a decline of 14·4 c. As already stated, this apparent decline in value was due principally to the largely increased production of bye-product coke-oven gas, most of which is used for fuel, and all is sold at first hand at much lower rates than those obtained for gas produced as a primary product at gas-works.

In a lengthy table, showing the production of coal gas by States and territories, a separation is made of the gas sold for illuminating and for fuel purposes. No claim is made for exactness in this separation, and the figures must be accepted as only approximately correct. In many cases, it is true, in order to encourage the use of gas for cooking purposes, the companies instal additional meters, and charge a lower price for such gas, though supplied from the same mains as the illuminating gas burned in the same houses. But in just as many cases, probably—particularly for household use—the gas for lighting and for cooking passes through the same meter, and the only estimates of the quantities used for the two purposes are roughly guessed at as a certain percentage of the total. When gas is used in large quantities for power purposes, separate meters are generally employed.

According to the best information obtainable, the quantity of gas sold for illuminating purposes in 1907 was approximately 30,156,771,756 cubic feet, valued at $23,119,423, or 77 c. per 1000 cubic feet; while that sold for fuel purposes was 24,662,913,069 cubic feet, valued at $13,342,881, or 54 c. per 1000 cubic feet. In 1905, the quantity of gas sold for illuminating purposes was 26,817,836,022 cubic feet, valued at $23,138,361, or 86·3 c. per 1000 cubic feet; and the gas sold for fuel purposes was 13,636,379,110 cubic feet, valued at $9,709,095, or 71·9 c. per 1000 cubic feet. The returns for 1907 show that Pennsylvania has superseded New York as a producer and consumer of coal gas. This has been largely due to the operations of the bye-product coke-ovens at Steelton and Lebanon. The production of coal gas reported from Pennsylvania in 1907 was nearly 9500 million cubic feet, about 75 per cent. of which was sold for fuel. New York produced nearly 8300 million cubic feet, of which nearly 5000 millions were sold for illuminating purposes. So that, while Pennsylvania's production exceeded New York's by more than 1000 million cubic feet, the value of the gas produced in New York exceeded that of Pennsylvania by $2,159,529, or 71 per cent. Massachusetts ranked third in the production of coal gas, with Ohio fourth, Michigan fifth, Illinois sixth, and Wisconsin seventh; all of these, with the exception of Ohio, having a larger production of coal gas on account of the operations of bye-product ovens. In the production of water gas, New York far outranks all the other States, with more than one-third of the total output. In the quantity of coal carbonized, Pennsylvania ranks first, with New York second, Massachusetts third, Illinois fourth, Michigan fifth, and Ohio sixth.

Fuel Purposes.—Owing partly to the increased production of gas from bye-product coke-ovens, and partly to the growing popularity of gas for cooking and other household heating purposes, a marked increase is shown in the proportion of gas employed for fuel, and a corresponding decrease in the proportion used for illuminating purposes. In 1902, the gas used for the latter purposes amounted to 80·45 per cent. of the total; in 1903, the proportion had fallen to 75 per cent.; in 1904, it was 74 per cent.; in 1905, it was 66 per cent.; and in 1907, it had fallen to 55 per cent. The proportion of gas used for heating purposes, on the other hand, has increased from 19·55 per cent. in 1902 to 45 per cent. in 1907. This is to be accounted for by the fact that many of the gas-making companies offer inducements in the way of lower prices for gas when used for cooking and heating purposes, even when drawn from the same mains as the illuminating gas (separate meters being installed); and the cleanliness and convenience of gas are not to be questioned. It must also be remembered that a large part of the gas produced at the bye-product ovens is used for iron and steel making—the ovens being operated in connection with the iron and steel mills. The actual quantity of gas consumed for fuel purposes has increased nearly 350 per cent.—from 5678 million cubic feet in 1902 to 24,663 millions in 1907.

Production of Oil and Water Gas—Since the manufacture of coke in retort-ovens assumed in 1897 an importance sufficient to be considered an independent industry, the problems regarding the supply of, and the demand for, the bye-products obtained have created a desire for statistical data on them as produced in gas-works; and as no other bureau of the Federal Government was charged with this duty at that time, the Geological Survey undertook the preparation of the special report on the production of gas, coke, tar, and ammonia in 1898. Since 1902, the statistics have been collected each year, with the exception of 1906. Similarly, the statistics of coal-gas production have created a desire for information as to the production of oil and water gas; and, in response to the numerous requests, this information has been collected for the reports for 1905 and 1907.

In the preparation of the report for 1905, returns were received from 477 oil and water gas companies; and they show that in that year the total production of water gas was 82,959,228,504 cubic feet, of which 5,547,203,913 cubic feet, or 6·7 per cent., were lost by leakage, &c.; leaving 77,412,024,591 cubic feet as the net production obtained and sold. In 1907, returns were received from 520 producing companies; and the production reported was 102,139,874,507 cubic feet, of which 7,505,261,777 cubic feet, or 7·3 per cent., were lost or unaccounted for, leaving 94,634,612,730 cubic feet as the net production. As the quantity of gas made and sold at coal-gas works and at bye-product coke-ovens in 1907 was 54,819,684,825 cubic feet, it seems that the consumption of water gas is nearly twice as much as that of coal gas. It also appears that while the average price of coal gas in 1907 was 67 c. per 1000 cubic feet, that of oil and water gas was 95 c.; this being due to the larger proportion of oil and water gas used for illuminating purposes, and also to the much lower price at which bye-product oven gas is sold. The oil and water gas used for illuminating purposes in 1907 was 71,931,606,896 cubic feet, or 76 per cent., while the quantity sold for fuel was 22,703,005,834 cubic feet, or 24 per cent., of the total.

Production of Coke.—The total quantity of coke produced in bye-product recovery coke-ovens and at gas-works in 1907 amounted to 8,093,144 short tons, valued at $30,332,644, as against 5,751,378 short tons, valued at $18,844,866, in 1905. The increase in the production of coke was 2,341,766 short tons, or 41 per cent.; while the value increased $11,487,778, or 61 per cent. The increase in the production of coke was almost entirely in the output from bye-product ovens, the quantity of this coke having risen from 3,462,348 short tons in 1905 to 5,583,068 short tons in 1907—a gain of 2,120,690 short tons, or 61 per cent.; while the production of gas-works coke showed an increase of only 221,076 short tons, or 10 per cent.—from 2,289,030 short tons in 1905 to 2,510,106 short tons in 1907. This larger proportionate production of bye-product coke in 1907 was responsible also for the greater percentage of increase in value; this coke being a metallurgical fuel, and commanding in the same markets a much higher price than the gas-works product. The average price for the latter and bye-product coke increased from $3·28 per ton in 1905 to $3·75 in 1907. The total value of the 5,583,038 short tons of bye-product coke included in the total production was $21,602,680—an average of $3·87 per ton; while the value of the 2,510,106 tons of gas-works coke was $8,729,964, or an average of $3·48 per ton.

The following tables are the totals of the detailed figures given in the report.

Production of Coal Gas and Bye-Product Coke-Oven Gas.

	1905.		1907.
Number of companies reporting	529	..	516
Coal carbonized, short tons*	8,187,812	..	11,490,661
Gas made, cubic feet	43,654,807,037	..	52,242,544,402
Gas sold—			
Lighting, cubic feet	26,817,836,022	..	30,156,771,756
Lighting, percentage	66	..	55
Lighting value, total	$23,138,361	..	$23,119,423
Value per 1000 cubic feet	$0 863	..	$0 770
Fuel purposes, cubic feet	13,636,379,110	..	24,662,913,069
Fuel purposes, percentage	34	..	45
Fuel value, total	$9,799,095	..	$13,342,881
Fuel value per 1000 cubic feet	$0·719	..	$0·540
Total, cubic feet	40,454,215,132	..	54,819,684,825
Total value	$32,937,456	..	$36,462,304
Total value per 1000 cubic feet	$0·814	..	$0·670
Gas unaccounted for, total cubic feet	3,200,591,905	..	3,422,859,577
,, ,, percentage	7·3	..	5·9

* Including 745,342 tons of coal carbonized in bye-product coke-ovens; none of the gas produced from it being sold.

Production of Oil Gas and Water Gas.

	1905.		1507.
Number of companies reporting	477	..	520
Gas made, cubic feet	82,959,228,504	..	102,139,874,507
Gas sold—			
Lighting, cubic feet	59,531,804,429	..	71,931,606,896
Lighting, value	$59,888,082	..	$68,323,836
Lighting, value per 1000 cubic feet	$1·005	..	$0·950
Fuel purposes, cubic feet	17,880,220,162	..	22,703,005,834
Fuel purposes, value	$18,184,418	..	$21,849,276
Fuel purposes, value per 1000 cubic feet	$1·017	..	$0·960
Total, cubic feet	77,412,024,591	..	94,634,612,730
Total value	$78,072,500	..	$90,173,112
Total value per 1000 cubic feet	$1·008	..	$0·950
Gas unaccounted for, cubic feet	5,547,203,913	..	7,505,261,777

Production of Bye-Products.

	1905.		1907.
Coke.			
Number of companies reporting	527	..	481
Total make, short tons	5,751,378	..	8,093,144
Value	$18,844,866	..	$30,332,644
Value per ton	$3·28	..	$3·75
Yield of coal in coke, percentage	70·25	..	70·70
Coal Tar.			
Number of companies reporting	521	..	488
Total make, gallons	80,022,043	..	103,577,760
Value	$2,176,944	..	$2,651,527
Value per gallon, cents.	2·72	..	2·60
Yield per ton of coal, gallons	9·79	..	9·04
Water-Gas Tar.			
Total make, gallons	9,230,411	..	14,414,017
Value	$245,252	..	$342,041
Value per gallon, cents.	2·66	..	2·40
Ammonia.			
Coal carbonized, short tons	7,194,910	..	10,461,646
Anhydrous ammonia or equivalent produced and sold, lbs.	22,455,857	..	37,560,858
Anhydrous equivalent in ammonium sulphate, lbs.	87,128,725	..	145,736,129
Anhydrous ammonia produced and sold as sulphate, lbs.	38,663,682	..	48,882,237
Anhydrous ammonia sold, value	$1,728,254	..	$2,601,057
Ammonium sulphate sold, value	$997,452	..	$1,525,472
Value received, total	$2,725,706	..	$4,126,529

Total Production from Coal Gas.

	1905.		1907.
Gas made, cubic feet	40,454,215,132	..	54,819,684,825
Tar made, gallons	80,022,043	..	103,577,760
Ammonia, anhydrous and sulphate, lbs.	61,119,539	..	86,443,095
Coke made, short tons	5,751,378	..	8,093,144
Gas unaccounted for	3,200,591,905	..	3,422,859,577

* Some of the figures under this heading were given last week; but they are reproduced for the sake of completeness.—ED. J.G.L.

The total quantity of coal carbonized or coked at gas-works and in bye-product ovens in 1907 was 11,490,661 short tons, of which 7,460,587 short tons were coked in bye-product recovery ovens and 4,030,074 tons used in gas-works. In 1905, there were 8,187,812 short tons of coal carbonized, of which 4,628,981 short tons were coked in retort-ovens and 3,558,831 tons used in gas-works. In 1904, the quantity of coal carbonized was almost equally divided between the coke-ovens and gas-works. The yield of coal in coke in bye-product recovery ovens in 1907 was 75 per cent. The quantity of gas-works coke produced in 1907 was 62 per cent. of the coal carbonized.

Many gas companies are also engaged in the electric light business; and the coke produced at the gas-works, as well as a considerable quantity of tar, is using for firing in the electricity plants. Other coal-gas producers are also producers of water gas, and the coke from the coal-benches is used for firing the water-gas plant. Some coke is employed in the carbonization of coal at certain of the gas-works. This is to be noted in the cases where the companies did not report any coke produced.

Production of Coal Tar.—Coal tar, as the raw material from which are obtained creosoting oils, aniline dyes, salts, and innumerable organic chemical compounds and medicinal preparations, is of much more economic importance in some of the European countries than it is in the United States. America is considerably in the rear, particularly when compared with Germany, in the development of chemical industries based on coal tar, the products of which are imported to the value of several million dollars each year. At the present time, coal-tar manufacture in the United States is confined principally to the production of creosote and of tars and tar pitches suitable for roofing papers, paving materials, &c. With the continued development of the retort-oven coking industry, however, and an assured supply of coal tar, there is every reason to believe that chemical industries dependent upon tar as a raw material will be established. The lack of such an outlet for one of the principal bye-products of retort-oven coke manufacture is in part responsible for the fact that the construction of bye-product oven plants has not been more energetically pushed in America.

The total production of coal tar, as reported to the Geological Survey in 1907 by 488 companies, was 103,577,760 gallons, valued at $2,651,527, against a production of 80,022,043 gallons, valued at $2,176,944, reported in 1905 by 521 companies. From this it appears that while the production of coal tar increased 23,555,717 gallons, or 20 per cent., the value rose only $474,583, or 22 per cent. The average price per gallon decreased from 2·72 c. in 1905 to 2·6 c. in 1907. The price for tar has shown a steadily declining tendency since 1903, when the average price reported to the Survey was 3·49 c. per gallon. It dropped to 3·04 c. in 1904, to 2·72 in 1905, and to 2·6 c. in 1907. The yield of tar per ton of coal consumed in 1907 ranged from 6·34 gallons in Pennsylvania to 19·63 gallons in Missouri. The price ranged from 2 c. in Illinois to 10·3 c. in Oregon. The average yield of tar per ton of coal for the entire United States was 9·04 gallons. In 1905, the average yield of tar was 9·79 gallons per ton of coal consumed.

Production of Water-Gas Tar.—The quantity of tar produced at water-gas works in 1907 amounted to 14,414,017 gallons, valued at $342,041, against 9,230,411 gallons, valued at $245,252 in 1905. There were 69 companies who reported a marketable product of water-gas tar in 1907. At many of the plants there is no market whatever for the product, and it is used for fuel at the works; no record being kept of the output. Where companies produce both coal and water gas, the water-gas tar, if sold at all, brings a lower price per gallon than coal-gas tar. It is interesting to note that the United Gas Improvement Company of Philadelphia are using at their works at Point Breeze in the coal-briquetting plant, pitch made from water-gas tar.

Production of Ammonia.—Only about one-fifth of the establishments producing gas and coke from coal report the recovery of ammonia, whether in the form of ammoniacal liquor, anhydrous ammonia, or ammonium sulphate. In making the reports on the quantity of ammoniacal liquor produced, somewhat different methods were employed. Some companies reported the production in liquor ounces selling at a certain price per 100 liquor ounces of a specific strength; others reported the production in gallons, sales being made at a certain price per pound or by the ammonia contained; whereas others reported the production in gallons of liquor at so much per gallon, according to the strength of the liquor. Then, again, the strength of the liquor is reported by some producers in ounces, by others in degrees Twaddel, and by others in the percentage of anhydrous ammonia. In compiling the statistics for 1907, a separate statement was prepared of the anhydrous ammonia produced, and to this extent the figures for 1907 differ from those of 1905, in which all the ammonia not sold as sulphate was included in the ammoniacal liquor. The production of liquor in 1907 amounted to 54,065,541 gallons (equivalent to 20,993,863 lbs. of anhydrous ammonia). In addition to this, the anhydrous ammonia reported as such was 16,566,995 lbs., valued at $1,472,881; making a total of anhydrous ammonia of 37,560,858 lbs., valued at $2,601,057. In 1905, the total quantity of anhydrous ammonia produced and contained in the liquor was 22,455,857 lbs., valued at $1,728,254.

Assessments at Shipley.—At the monthly meeting of the Shipley Urban District Council, the Clerk (Mr. I. Lindow) reported the receipt by the Gas Committee of a letter from the Assessment Committee of the North Bierley Union, saying they had confirmed the increase of £1000 in the assessment of the gas-works. The Clerk also stated that, though it was admitted that there had been a decrease in the sale of gas in Shipley since the Council acquired the works, the Official Valuer contended that the increased assessment was justified, because the gross profits had considerably increased since the Council acquired the works. The Gas Committee considered that the Assessment Committee were most unjust; but, in view of the law as to assessments, they thought it inadvisable to appeal to Quarter Sessions. The Clerk further reported that the Assessment Committee had placed an assessment upon all electric motors let out on hire by the Council. As this would be a charge upon the user of the motor, the Electricity Committee expressed no opinion on the matter, and suggested that if the occupiers were at all aggrieved they must appeal against the assessment. The policy of both Committees was endorsed by the Council.

WATER SUPPLY IN THE KENT DISTRICT.

Origin and Development of the Kent Water Company.

In a recent issue of the "JOURNAL," reference was made to the retirement of Mr. William Morris, the Engineer in charge of the Kent district, from the service of the Metropolitan Water Board. It was then mentioned that Mr. Morris and his father had been associated for many years with the Kent Water Company—the only one of the Metropolitan Water Companies whose entire source of supply was deep wells in the chalk. In view of the severance of his connection with the undertaking, it occurred to the Editor of the "Kentish Mercury" that an account of its origin and development would be interesting. This was furnished by Mr. Morris in an interview with a representative of that paper, from whose report the following particulars are taken.

It was as long ago as 1701 that William the Third granted to certain persons letters patent, for a term of 500 years, for the privilege of breaking up the streets "in the manors of Sayes Court and East Greenwich." This was the beginning of the undertaking which took to itself the style of "The Ravensbourne Water-Works." The engineer was no less a person than the famous Smeaton, the builder of the first Eddystone lighthouse; and the power for lifting the water from the Ravensbourne and forcing it along the mains was supplied by a water-wheel in Deptford. The old wheel was used to supply some of the lower parts of the district until so recently as 1850, when it was taken down.

The Kent Water Company proper was started by an engineer named Ralph Dodd—an enterprising man who was well known at the time by reason of his scheme for driving a tunnel under the Thames at Gravesend. His plan was to take water from the Thames, store it in a reservoir in Greenwich, and pump it up to another reservoir on Blackheath. But, instead of constructing these works, the Company obtained their Act of Parliament in 1808, and bought the rights and powers of the Ravensbourne Water Company for the sum of £65,000. In the year named, several of the other London Water Companies came into existence. The wheel continued to be used, conveying water to the lower parts of Deptford and Greenwich through pipes which were of wood; the pressure being so slight that even in the low-lying districts the supply could only be afforded on the ground floor. This being an unsatisfactory state of things, Mr. Rennie, the celebrated engineer, was consulted; and on his advice it was decided to instal a steam pumping plant and lay iron pipes. There was much discussion, however, as to whether the pipes should be of iron or of stone-ware; and what decided the Company to use iron pipes was the necessity of supplying water to houses on the higher levels, such as Blackheath. In 1812, the first steam-engine was started, and there, in the "gardens," it is still running its fly-wheel—spinning after all these years. In 1824, it was found necessary to instal a second engine.

The intention at the starting of the Company was to carry the service into Rotherhithe and Bermondsey; and to this end the work of laying the necessary pipes was begun. But at the same time the Surrey Canal Company were engaged on the business of constructing a lock. The water-pipes were in the way of the lock, and the lock was in the way of the water-pipes; and as the Water Company laid their pipes, so the Canal Company pulled them up. A lawsuit was naturally inevitable; and as the result the Canal Company had to make a culvert to receive the pipes. Meantime, the Commissioners of Woolwich, who, in 1808, had obtained from Parliament powers for the construction of water-works, asked the Company to extend their operations to this district. Their energies being thus diverted, it was some years before water was actually laid on to the pipes through the culvert. At Woolwich, the Company took over from Sir Thomas Maryon-Wilson the lease—which only expired last year—of some springs; but they did not use their powers in this respect, supplying the water from Greenwich. A contract was made with the Government for furnishing water to Woolwich Dockyard, the barracks, and other Government establishments in the district.

Just about this period in the Company's history, the value of the shares fell very low. Sometimes they paid a dividend; but often, when pipes had to be laid and paid for, they could not do so. But about 1845 things "woke up" financially; the old pumping-engines were modernized; and a filter-bed was constructed. Up to that time the water had been supplied just as it was drawn from the Ravensbourne. The filter-beds are not used now, as the water pumped from the chalk does not require purification. In 1850, a Cornish pumping-engine was put up; another followed in 1853, and an additional filter-bed was constructed. But the Ravensbourne, as a source of water supply, was becoming out of date, for this, or shortly before it, was the era of the beginning of sewerage. People had begun to drain their houses; but they were sublimely indifferent as to the destination of the sewage, while the Ravensbourne was close at hand. Naturally, the Company complained to the Commissioners of Sewers as to the pollution of the stream; and this body finally evolved a scheme for taking the sewage elsewhere. The new sewers had the effect—not altogether expected—of intercepting a very large quantity of water which had formerly gone to feed the Ravensbourne; and by 1855 it was as much as the Company could do to draw sufficient for their purposes. Then it was that, acting on the advice of Mr. Morris, sen., the first well was sunk into the chalk—at Coldbath, where the little engine-house still stands; and the results were beyond expectation.

About this time an undertaking was started under the magniloquent style of "The Woolwich, Plumstead, and Charlton Consumers' Pure Water Company." They had no parliamentary powers, but they had a brickfield, a well, and a reservoir; and they thought that all that remained to be done was to lay down pipes. For this purpose the local authorities allowed them to open the streets. With fine optimism, they afforded supplies at about half the charges of the Kent Company, who then levied a toll of about 5s. a room. While they got on very well for a time, as long as their operations were confined to the lower levels, it was a different matter when they came to the houses on the hills. An attempt was made to overcome the difficulty by building a reservoir on Woolwich Common; but in 1861 the Company was wound up in the Court on Chancery to begin with, but in the Bankruptcy Court to end with. The undertaking was sold by auction, and it was

bought by the Chairman (a Mr. Davies). He subsequently sold it to the Kent Company, who sank a well at Charlton, in connection with the spring leased from the Maryon-Wilson family, and another on a second piece of land they acquired. The first well was ruined by the construction of the main sewer to Crossness, which passed close to it; and in the end the engines were removed from both wells.

In 1850, the Ravensbourne having, as a source of supply, been altogether abandoned, the North Kent Company was formed to supply Dartford, Crayford, Bexley, Bromley, &c.; but their rights were purchased by the Kent Company, and in 1864 an Act was passed amalgamating the two undertakings. In 1867, wells were sunk at Shortlands and Crayford—the former to supply Bromley and the latter the district in the neighbourhood. In Dartford water-works had been constructed by the Local Authority; but the undertaking had been dogged by misfortune, for the well fell in and the reservoir leaked. As the result of an election, a party adverse to water-works was returned, and the plant was sold by auction—Mr. Morris, sen., buying the boilers for use at Deptford. Nothing was done in the way of supplying Dartford until 1866, when some of the townsfolk began to set about forming a Company. The Kent Company, having powers under their Act, set to work at once, constructed a main, and had the water in Dartford before the promoters of the other Company had got their Bill before a Committee. In the result, the Bill was thrown out; and the Kent Company began to supply the town.

The Company had a rare fight with the West Kent Drainage Board, formed in 1877 for the drainage of Beckenham, Bromley, &c., as they wished to run their sewer close to a well which had been constructed at Crayford. A point was that they could not discharge sewage into the Thames without the consent of the Thames Conservancy, and there was trouble at that time between that body and the Metropolitan Board of Works—the former complaining that the sewage of the latter was silting up the river. Mr. William Morris obtained from the Secretary to the Conservancy the statement that they would not allow raw sewage to be put into the Thames; and when the Bill came before the House of Lords, it appeared that there was no provision for settling beds, and it looked bad for the Bill. But the promoters, knowing who was "pulling the wires," made peace with the Kent Company, and arranged accordingly to divert the sewer. The opposition was withdrawn; some sort of arrangement for purification was devised; and the Bill eventually got through. Then the people living in the Cray Valley began to ask what was the good of sewers without a water supply; and the Kent Company, having obtained the necessary powers in their Act of 1877, increased their area of supply to 120 square miles, and sank a well at Orpington. In 1885, the district of Knockholt, Cudham, &c., where the people had really been dependent on rain water, was taken in—thus enlarging the area to its present extent of 178 square miles, about 30 miles of which are in the County of London. Works were established at Wilmington and Southfleet, and in 1898 at West Wickham, and afterwards at Westerham, where the people had set up small water-works of their own. Subsequently the undertaking passed into the hands of the Metropolitan Water Board, under the Metropolis Water Act of 1902.

WATER SUPPLY OF CAMBRIDGE.

Important Report to the Local Government Board.

In the "JOURNAL" for the 31st of March last, we reported the proceedings at an inquiry held at Cambridge, by Dr. Theodore Thomson and Mr. P. M. Crosthwaite, M.Inst.C.E., on behalf of the Local Government Board, at the request of the Corporation and University, in regard to the water supply of the city and the circumstances calculated to affect it. The inquiry, which extended over two or three days, was conducted partly by hearing evidence in public and partly by personal inspection of the local conditions in the neighbourhood of the source of supply. The Corporation and University were represented by Mr. H. St. J. Raikes, who stated that the inquiry was not directed to making any examination of the present sources of the Water Company, or of the water they sent out, but merely to finding out whether a certain proposed scheme would be likely in the future to contaminate the supply. Mr. Balfour Browne, K.C., who watched the proceedings on behalf of the Company, stated that though they had not asked for the inquiry, they were exceedingly pleased that it had taken place, in order that the public anxiety which was felt by some people in Cambridge should be allayed. After the Inspectors had visited the various places concerned, they held a further sitting to ascertain whether there were any additional representations to be made; and as there were none, Dr. Thomson announced that he and his colleague would report in due course. This they have now done; and the result is an elaborate document in which the sources of supply, the geological character of the strata in which they are located, and the various means of pollution to which the water is exposed, are fully dealt with.

Within the area served by the Company, there is a population of 65,000; and in 1907 the total quantity of water supplied for all purposes was 553,154,000 gallons. The sources of supply are to the east of Cambridge, near the villages of Cherry Hinton and Fulbourn. That from the Cherry Hinton works is derived partly from a spring which comes to the surface on the southern boundary of the village, and partly from the strata underlying the station, whence water is raised by pumping the water of the spring, issuing from the lower chalk, which is collected in underground open brickwork chambers, and conveyed to the pumping-station, where it is delivered into wells lined with cast-iron cylinders and concrete bottoms. At the Fulbourn works the supply is obtained entirely from a well sunk in the lower chalk. The report is illustrated by charts and tables showing the relations of bacterial life in the water to rainfall and other modifying conditions.

As the outcome of their investigation, the reporters express the opinion that the continued use of the portion of the Company's water which is derived from the lower chalk is, under present conditions, dangerous to the lives and health of the large and important community to whom it is supplied; and this notwithstanding the absence—to which they give due weight—of evidence that the consumption of this water has been causatively associated with evil consequences in the past. They do not deem it necessary to discuss this latter consideration in detail. They think it should be sufficient to recall the number of instances in which the use of public water supplies of suspicious origin has led, after a long series of years free from indication of harm to the consumers, to final catastrophe. It is, therefore, in their view, imperative that the water in question should be dealt with as unsafe for drinking purposes. After discussing the possibility of devising measures by which the water might be safeguarded against dangerous pollution, they state the conclusion that such measures are not practicable.

There remains the further question whether any procedure could be adopted, before the delivery of the water for consumption, that might be trusted to secure the removal or the destruction of any dangerous matter that it might contain. The reporters point out that this end could be attained by storage for a sufficient length of time before delivery—a method which has been resorted to on a large scale with apparently satisfactory results. But chalk waters do not bear storage well in open reservoirs; and, indeed, it is not probable that they would remain in satisfactory condition if the period of storage were sufficient for safety, even in covered reservoirs, the cost of which would be heavy. Filtration through sand is another method that might be thought of; but experience points to unsatisfactory results of this process when applied to chalk waters, since these do not readily lend themselves to the formation of an effective purifying layer on the surface of the filter-bed. As to other methods of filtration, such as that involving the use of a coagulant, the information available as to results obtained is not such as would justify confidence as to the attainment of consistently effective purification. The removal of micro-organisms from chalk waters by means of softening processes, such as the Clark, has also been favourably spoken of; but, though this method may, perhaps, be regarded as promising, the reporters consider that the data available as to results obtained are not at present sufficient to afford certainty that in this way safety would be secured. Lastly, consideration may be given to the practicability of effecting sterilization, by chemical means or otherwise, of the wter before delivery to the consumer, in which connection, for example, the ozone process may be thought of. The data, however, as to this process are at present too scanty to warrant its acceptance without further evidence, of a satisfactory kind, on the subject.

Having regard to the foregoing facts and considerations, the reporters come to the conclusion that, in order to secure from contamination the water furnished by the Company, the whole of that part of the supply which is derived from the lower chalk should be abandoned. The remainder, which is obtained from the greensand, may, they think, safely be used; but it should be supplemented either by further utilization of the water in that formation, or, in the event of its insufficiency, by resorting to sources in the chalk in a neighbourhood where these are not exposed to the risk of dangerous pollution.

The report recently came before the Cambridge County Council at a special meeting, and was referred to the Public Health Committee.

In view of the possibility of the report above noticed creating a wrong impression, the Vice-Chancellor of the University (Mr. A. J. Mason) has addressed to "The Times" a letter on the subject, in the course of which he made the following remarks.

The question of the Cambridge water supply has received for some time the very careful attention of the University authorities, of the Town and County Councils, and of the Water Company. The standard of purity of our water is being constantly raised, and I am assured that at the present time, alike from the chemical and from the bacteriological point of view, the Cambridge water, both at the sources and in the mains, has attained a higher degree of purity than at any time during the period that it has been kept under examination.

The only area near the sources of supply in which there has been any appreciable amount of typhoid fever during the last few years has been that which contains the Fulbourn Asylum; and the Local Government Board Inspectors are satisfied that, with proper precautions, there is no danger of contamination of the water supplied to Cambridge from this area. The adjacent areas of Fulbourn village and Cherry Hinton are under the constant supervision of the County Council, under whose direction during the last few years a rigid inspection has been maintained, and great improvements in the conditions there existing have been effected.

It is understood that the Water Company have been adopting the precautions suggested by modern investigation to improve the condition of the water at the wells. The whole character and source of the supply is under constant supervision, and the fact that since the beginning of the century the enteric fever death-rate per 1000 living has only once been higher than the average in England and Wales (0·1 per 1000, compared with 0·08 per 1000), in two years—1904 and 1907—has been *nil*, and during the whole period has never been more than 0·1 per 1000, affords ample evidence that the care bestowed on the Cambridge water supply has not been without result or been in vain. There is, I am assured, no cause for alarmist reports or articles.

Electric Light Failure at Camborne.—The Camborne Urban District Council were at their last meeting called upon to transact part of their business by candle light, owing to a failure of the electric current. The arrival of an official with the—under the circumstances—welcome packet of candles, led to a considerable display of that humour for which a lighting failure always appears to afford such ample scope. After all, of course, the councillors could well afford to take the matter as a joke, for it is at any rate possible to talk in darkness or semi-darkness. Far different, however, is the case of business establishments, where the sudden deprivation of the only immediately available source of illumination is bound to be a serious inconvenience, and may prove a catastrophe. In Camborne, several of the shops, &c., were in darkness for a time; and oil-lamps, candles, &c., had to be resorted to. With that strange perversity of electricity so often noticed, too, the failure occurred during the busy part of the week—namely, on a Friday evening. Really, if this sort of thing continues, we may soon expect electric light users to anticipate "week ends" with something approaching dread.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

We have again arrived at the period of the year when it is customary to look back upon what we have been doing, in order to satisfy ourselves whether we have been going forwards or backwards. Having collected materials with which to approach this task, I can only conclude that, so far as gas making in Scotland is concerned, the year 1908 will not stand out prominently in history in any one particular. In the statements I am about to submit, the figures quoted are those contained in the balance-sheets of undertakings, most of which were presented about the middle of the year. Statistics for the latter half of the year are, of course, not yet available. Those with which I deal are, with a very few exceptions—and these quite explainable—as satisfactory as could be wished. But it is well known that since balance-sheets were made up there has been a considerable decrease in the output of gas, owing, probably, to three causes—the exceptionally fine weather of the summer and autumn; dulness of trade; and the higher price charged for gas, consequent upon the rise in coal. The figures given in the balance-sheets showed that in all the leading towns there were satisfactory balances over after meeting all charges, with the exceptions of Greenock and Falkirk, where there were considerable deficits, brought about in Greenock by the refusal of the Corporation to raise the price of gas in 1907, and in Falkirk by their only raising it by a penny. In both towns the price of gas has been raised—in Greenock by 2d., and in Falkirk by 4d., per 1000 cubic feet—so that the communities are paying this year what they should have paid last year. During the present year there have been the following reductions in the price of gas: Arbroath 2½d., Dundee 2d., Hawick 2½d., Galashiels 2d., Kirkcaldy 2d., Hamilton 2½d., Cupar 3½d., Broughty Ferry 4d., Paisley 2d., Glasgow 3d., Perth 1d., and Kilmarnock 2½d. The cheapest gas in Scotland is now being sold at Coatbridge, at 2s. per 1000 cubic feet for lighting and 1s. 7d. for power. There were the following increases in production: Dundee 67 million cubic feet, Stirling 7 millions, Glasgow 164 millions, Perth 2½ millions, Aberdeen 65 millions, Edinburgh 86 millions, and Kilmarnock 1½ millions.

The variations in the price of coal during the year are shown in the following table:—

	Ell.		Splint.		Steam.	
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
January. .	13 0	to 14 6 ..	14 0	to 14 6 ..	12 6	to 12 9
April. . .	10 3	,, 11 3 ..	11 0	,, 11 3 ..	10 3	,, 10 6
July . . .	10 6	,, 12 6 ..	10 9	,, 11 0 ..	10 0	,, 10 3
October . .	10 6	,, 12 3 ..	11 0	,, 11 3 ..	10 3	,, 10 6
December .	9 9	,, 10 6 ..	10 3	,, 10 9 ..	10 0	,, 10 3

It will be seen that there was a big drop in prices during the first quarter of the year, but that afterwards the market did not vary to any great extent. Prices had receded by the time that coal contracts came to be considered, with the result that there were considerable reductions in price, as compared with the prices entered into in 1907, in Edinburgh, Aberdeen (1s. 9½d. per ton), Glasgow (1s. 9d. to 2s.), and Dundee (1s. 2d.). Recently prices for coal have been tending more downwards than they did for some months. Whether this movement is to continue will probably depend chiefly upon the state of trade. Miners' wages are not likely to be of account; and the probability is that prices will yet become a little easier. At the same time it is not to be overlooked that, compared with two years ago, ell is from 9d. to 1s., and splint from 1s. to 1s. 3d., per ton lower, and that steam coal, which is the variety used for manufacturing purposes at home, is being sold at the same price as it was then. It is noticeable that the export of coal from Scotland is about 140,000 tons less than it was in the previous year, which seems to point to the abolition of the coal-tax not having removed any burden upon foreign purchasers, and to the view that in foreign countries industry has not been in a prosperous condition, any more than at home.

The following Companies were registered as joint stock concerns: Cumnock, South Queensferry, Dundonald, Irvine, Leven and Methil, East Wemyss and Buckhaven, and Newton-on-Ayr.

Transfers were not carried through anywhere; but in several cases there were negotiations. At Cowdenbeath, the Town Council in February appointed a Committee to consider the advisability of a transfer, and in July the Council asked the Gas Company to allow a valuator on their works. There does not appear to have been anything further done. The long and bitter negotiations for a transfer at Selkirk came to an end in March last, when a poll of the ratepayers was taken, and when, out of a constituency of 1446, there voted 743; and the scheme was rejected by 51 votes. In Fraserburgh, a motion to confirm the adoption of the Gas Supply Acts was carried in the Town Council in March by five votes to three; but the majority not amounting to two-thirds of the members present, further negotiation was stopped. In Lerwick, a transfer is under the consideration of the Town Council; but slow progress is being made—the Council being undecided as to whether they should take over the gas undertaking or adopt a petrol gas system. Quite recently the Kirkcaldy Town Council have taken up consideration of a transfer, not for the first time. They have been in negotiation with the Gas Company, in a friendly way, and at present are proposing to take the opinion of a financial expert upon the question of the probable financial results of the step. The Glasgow Town Council in August agreed with the Busby Gas Company to acquire the portion of their undertaking lying within the Glasgow area of supply for £9000; but since the agreement was entered into, questions have arisen as to the taking over of the whole undertaking of the Company, and the transaction has not yet been completed.

Changes among gas managers have been somewhat numerous. Mr. John F. Robertson, foreman in the Alloa Corporation gas-works, was appointed Manager at Polmont; Mr. W. S. Easson, Assistant to his father at Selkirk, was appointed Manager at Jedburgh; Mr. J. Scott, son of Mr. J. B. Scott, of Cowdenbeath, was appointed Manager of the new gas-works which are being erected at Kennoway; Mr. D. Small, also of Cowdenbeath, was appointed Manager of the new works which are being erected at Largo and Lundin Links; Mr. T. Lindsay, meter inspector in Gourock, was appointed Manager of the Gourock Corporation Gas-Works; Mr. J. Lang, of Fraserburgh, was appointed Manager at Alexandria, and Mr. H. G. Ritchie, Assistant at Kirkcaldy, was appointed Manager at Fraserburgh; Mr. John Ireland, jun., of Tayport, was appointed Manager at Auchterarder; Mr. J. M'Leod, of Kirkintilloch, was appointed Manager at Greenock, in room of Mr. W. Ewing, resigned; Mr. J. Bell, Assistant at Airdrie, was appointed Manager at Kirkintilloch; Mr. Walter Grafton, of Beckton, was appointed Assistant General Manager at Glasgow, in succession to Mr. James Lowe; and Mr. J. Purves, of Leeds, was appointed Manager of the Ayr Gas Company, in succession to Mr. W. Smith, resigned.

The mortality among gas managers has been small. In May, Mr. R. S. Carlow, formerly of Arbroath, and Mr. John M'Gilchrist, of Gourock, died on the same day; and Mr. A. Lobban, of Auchterarder, died in July.

One new gas-works—that at Kirkintilloch—was inaugurated in June. Other new works were sulphate plant at Dumfries, purifiers in Dundee (still under construction), and gasholders at Elgin and Helensburgh.

Of other incidents connected with gas supply, the most outstanding was the procuring, by the Edinburgh and Leith Gas Commissioners, of statutory authority for the reduction of the illuminating power of the gas from 20 to 14 candles, and for other purposes, of which notice is taken below. The same Commissioners also succeeded in effecting a settlement of the litigation against them by Messrs. James Muir and Son, Limited, with reference to the pollution of a brewery well, by a payment of £4600, under conditions.

These items exhaust the list which I have culled from the year's doings relative to gas supply. If they are not brilliant, they at least show that steady and continuous work is being prosecuted with a success which is gratifying, though slightly marred by adverse industrial conditions; and there is nothing in them which bars the belief that when times improve the gas industry will press forward with renewed vigour, and be able to confirm the view that it still is, as it has shown itself to be, one of the most benign of all the industries prosecuted by mankind.

The Act of Parliament confirming the Provisional Order of the Edinburgh and Leith Gas Commissioners received the Royal Assent on Monday of this week; and the measure at once became law. The Commissioners accordingly now possess power to reduce the illuminating quality of the gas to 14 candles; to raise by mortgage £800,000 with which to redeem the annuities payable to the shareholders of the old Gas Companies; and to create a superannuation fund for officials and servants. These are the principal objects of the Order. The proposals of the Commissioners were fully described in the "JOURNAL" at the time the inquiry into them was held in Edinburgh, at the end of July last; and a summary of the Order as it passed the Houses of Parliament was given in the last issue (p. 841). There has been some delay in the passing of the confirming Act, which has been due to the vigilance of officials of the Scotch Office. The action taken there has resulted in some provisions being inserted in the Act—of course, after negotiation with the Gas Commissioners, some of whom have been in London on the subject—which were not before the Parliamentary Commissioners in Edinburgh. One of these new provisions is that the money to be borrowed must be repaid in thirty years. The Commissioners did not propose any limit, but were to repay as the sinking fund allowed. An entirely new provision is that the Commissioners are required, for the purpose of meeting any deficit on the sale of the disused gas-works, to contribute, in each year, from the revenues of the undertaking, sums equal to 2d. per 1000 cubic feet of gas sold; and it is allowed they may apply this money for the redemption of annuities and the repayment of money borrowed. This provision points clearly to its being in the contemplation of the Scotch Office that the annuities should not be all redeemed at once, because, should the Commissioners redeem all the annuities in May next, which is the first opportunity for redemption, and go on for twenty-nine years setting aside the equivalent of 2d. per 1000 cubic feet of gas sold, how could they, even after the first year, apply any part of the fund so set apart in the redemption of annuities? Another new provision is that prior to the scheme for superannuation coming into operation, the Commissioners are required to submit it to an actuary—a Fellow of the Faculty of Actuaries in Scotland, approved by the Secretary for Scotland—who shall consider the scheme, and report as to its solvency; and if he consider the scheme not solvent, the Commissioners shall contribute to it a sum sufficient to put it on a sound financial basis. Very important alterations have been imposed upon the Commissioners, in a series of added enactments, with reference to the treatment of their annual accounts. Hitherto the Commissioners have appointed their own Auditor, and fixed his remuneration, and appeal to the Sheriff of the Lothians and Peebles, or his Substitutes, against the annual accounts, after their adoption by the Commissioners, has been open to any Commissioner, to the Corporations, and to any creditor holding a security on the undertaking, within one month of the adoption. The accounts, also, have been open for inspection for a month before adoption to every creditor holding a security on the undertaking; and inspection of the accounts has been open to the public, at the offices of the Commissioners, at all reasonable hours, on payment of 1s. for every inspection. By the Act which has just been passed, the Auditor is to be appointed by the Secretary for Scotland, and shall be a member of the Society of Chartered Accountants practising in Edinburgh. The Commissioners are to pay him such remuneration as may be agreed upon, or, failing agreement, as may be fixed by the Secretary for Scotland, on the application of either party. And, further, the right to inspect the annual accounts, and the right to appeal against them to the Sheriff, is extended to every ratepayer in Edinburgh and Leith, and every gas consumer; and these ratepayers and consumers, on payment of 1s., are to be entitled to a copy of the accounts. These new enactments regarding the accounts and their auditing may not have much effect upon the fiscal policy of the Commissioners, but undoubtedly they are of a restrictive nature, and are in keeping with the trend of present-day legislation, in the direction of enlarging the "rights" of the irresponsible in the matter of curtailing liberty. For example, a person who pays, it may be, less than £1 a year for gas, has now power to invoke the law upon any item of expenditure

which may be stated in the gas accounts; and he might be able, in the cold criticism of a law court, to obtain a decision that a certain item was not strictly legal. We do not require to travel far for an illustration of how this aspect of the business would work out. In this Act of Parliament, the Commissioners obtained authority to reduce the illuminating power of the gas. The Commission is dominated by the Corporations of Edinburgh and Leith, and it was therefore desirable, in the interests of the Commission, that the members of these Corporations should understand what the proposals of the Commissioners were. Accordingly, the whole of the Town Councillors were invited to visit the Granton Gas-Works. It was a necessity, on account of the distance to be traversed and the time to be occupied, to provide carriages and luncheon for the company. At the first meeting of the Commissioners after the event, Judge Douglas—one of their own number—called the expenditure in question. If such were done by a Commissioner, what may be expected of some in the multitude of ratepayers and gas consumers, who have now the power to bring the Commissioners to book for such an expenditure? Yet there can be no question that the expenditure upon the occasion of the visit in the beginning of October was well justified, for, at the conclusion of Mr. Herring's explanation of the method of testing gas, one Councillor remarked that he had learned more about gas in the preceding ten minutes than he had in all his life before. This is the sort of expenditure which would be struck at by an irresponsible, possibly splenetic, ratepayer or consumer; and it is open to doubt whether, even in the interests of so-called purity of administration, such powers should be given as have been here, which are altogether of the nature of the tail wagging the dog.

The Wishaw Town Council on Monday—Provost Thomson presiding—agreed that the Town Clerk should reply to the inquiry by the Secretary for Scotland as to how the Council were providing for accrued and prospective deficiencies in connection with the gas undertaking, referred to last week, in the following terms: "The Town Council desire me to state that, seeing it is now so late in the year, and that any increase in the price of gas would cause considerable expense, they consider that they would not be justified in making any alteration in the price at present. An endeavour is being made, however, to reduce the general working costs at the gas-works. The Council are going thoroughly into the financial position and the working of the undertaking, so that they may, at the beginning of the next financial year, be in a position to lay before the Secretary for Scotland a thoroughly satisfactory scheme for meeting the wishes of the Department. The Town Council do not consider it advisable to levy a gas contingent guarantee rate before the present Committee exhaust their inquiry."

At Burntisland, where the output of gas has doubled within the last ten years, there is a proposal for the erection of new Corporation gas-works. The subject was considered by a Committee of the Council on Wednesday, before whom plans were laid, and probable costs given, for the erection of gas-works at Rossend Farm, outside of the town; also the costs of a railway siding and of a bridge, and other works relative to the providing of gas-works capable of making 50 million cubic feet of gas annually. The present output is over 20 million cubic feet a year. Mr. A. Ross, the Manager, had prepared the plans and made calculations as to costs. In his estimate, the entire cost was under £12,000. He pointed out that the cost of a new gasholder, erected on the existing site, would be between £2500 and £3000; but that it would only tide over their requirements for ten years or so, and they would then have to face the question of enlarging the gas-works. The Committee, after consideration of Mr. Ross's report and plans, agreed that he should make up a further report, giving the various details in figures, and that his report should be circulated among the members of the Town Council; the whole scheme to be then considered by the Council at a meeting to be called for the purpose. It was suggested that a better site for the gas-works would be at Rossend Point, where it was the contention that rock would be obtained for the making of concrete for a new graving dock; and Mr. Ross being favourable to the suggestion, it will be dealt with in his forthcoming report.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Dec.* 24.

The improvement in the market last week has been continued, and prices have further advanced; the closing quotations being £11 3s. 9d. to £11 5s. per ton f.o.b. Hull, £11 6s. 3d. per ton f.o.b. Liverpool, and £11 8s. 9d. per ton f.o.b. Leith. The upward movement has also attracted the attention of buyers abroad, and there have been considerable inquiries. But these buyers have not come into line with the higher prices; and, consequently, there has not been much direct business. The forward position has also been inquired for; but the ideas of makers are out of the reach of buyers, and no important business has been reported. For January-June delivery, as high as £11 12s. 6d. and £11 15s. per ton, according to port, is being quoted.

Nitrate of Soda.

The market is unchanged, with quotations on spot at 9s. 7½d. per cwt. for 95 per cent., and 9s. 10½d. for refined quality, less 2½ per cent. discount.

Tar Products. LONDON, *Dec.* 28.

Markets for tar products remain quiet, and, owing to the holidays, little business has been done during the past week. Pitch remains in about the same position, and orders are still difficult to secure. Continental consumers report having declined offers for delivery all over next year at very low figures. In England, business continues to be done on the east coast for prompt delivery at 18s. to 18s. 6d. Creosote remains firm, and some of the makers are advancing their prices; but it is possible to secure some of the London makes at 2⅜d. to 2⅝d. Benzol is still very weak, and sales have been made in London at 6½d. Fifties are also quieter; while there does not appear to be much demand for toluol. Solvent naphtha is steady, but the principal buyers seem to have covered their immediate requirements. Carbolic acid is very quiet, and business has been done for prompt delivery on the east coast at 1s. Naphthalene is depressed, and stocks are difficult to clear. Salts are fairly well maintained.

The average values during the week were: Tar, 10s. 9d. to 14s. 9d., *ex* works. Pitch, London, 18s. 6d.; east coast, 18s. to 18s. 6d.; west coast, 17s. 3d. to 18s. 3d. f.a.s. Mersey, 17s. 3d. to 17s. 6d. other ports. Benzol, 90 per cent., casks included, London, 6½d.; North, 6d.; 50-90 per cent., casks included, London, 7½d.; North, 7d. to 7¼d. Toluol, casks included, London, 9½d.; North, 9d. Crude naphtha, in bulk, London, 3⅜d. to 4d.; North, 3½d. to 3⅝d.; solvent naphtha, casks included, London, 11d. to 11¼d.; North, 10d. to 10½d.; heavy naphtha, casks included, London, 11d. to 11¼d.; North, 10d. to 10⅜d. Creosote, in bulk, London, 2⅜d. to 2⅝d.; North, 2⅜d. to 2⅜d. Heavy oils, in bulk, 3d. to 3 1/16d. Carbolic acid, 60 per cent., casks included, east coast, 1s. to 1s. 0¼d.; west coast, 1s. Naphthalene, £3 10s. to £6 10s.; salts, 35s., packages included and f.o.b. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

This market has been very firm indeed throughout the past week, and prices have advanced all round. The principal gas companies now quote £11 15s. for forward; while the ordinary London makes could be secured at not under £11 2s. 6d. to £11 5s. In Hull, £11 5s. has been paid for January delivery for ordinary makes. In Liverpool, £11 7s. 6d. to £11 8s. 9d. is the ruling figure. In Leith, £11 12s. 6d. is asked; and the majority of makers appear to be out of the market, declining at present to quote for forward delivery.

COAL TRADE REPORTS.

Northern Coal Trade.

After a few days of somewhat heavy pressure in the demand, the Northern coal trade has now felt the interruption of the holidays, and of the reduced output which will continue for the rest of the month. Under such circumstances, where coal is needed early there are steady prices quoted. Best Northumbrian steams are from about 10s. 9d. per ton f.o.b., but with lower prices for forward delivery. Second-class steams are from 9s. 9d. to 10s. 3d.; and for steam smalls—which are somewhat scarce—from 5s. to 6s. per ton is the current quotation. In the gas coal trade, the season of fullest demand is now known. The deliveries have been very heavy until the holidays, and must be expected to be so when production is again full, for perhaps three weeks. Durham gas coals vary in price from 9s. to 10s. 1½d. per ton f.o.b., according to quality, with the customary addition for "Wear specials." There are small sales being made for export; but for long forward delivery, contracts are not now so readily arranged, as coalowners have to take into consideration the effects that may be anticipated from the Mines Eight Hours Bill when it comes into force. At present, they incline to adhere to current values for forward sales. In coke, the markets are steady; but the abundance of gas coke makes it weak. The quotation for good qualities of the latter may now be given as from about 13s. 6d. to 14s. 3d. per ton f.o.b.

Scotch Coal Trade.

The market is quiet. Ell for shipment continues in poor demand, owing largely to the completion of Baltic contracts. Splint is in fair request, but not anything approaching what is usual at this season of the year. Steam coal is quiet. Treble and double nuts are in good demand, but all other washed stuffs are in poor request. The prices quoted are: Ell 9s. 9d. to 10s. 6d., splint 10s. 3d. to 10s. 9d., and steam 10s. to 10s. 3d., per ton f.o.b. Glasgow. The shipments for the week amounted to 298,200 tons—an increase of 2238 tons upon the preceding week, and of 18,855 tons upon the corresponding week of last year. For the year to date, the total shipments have been 14,272,359 tons—a decrease of 141,538 tons upon the corresponding period.

POCKET BOOKS, CALENDARS, &c.

As is customary at this season of the year, we have to acknowledge the receipt of numerous articles calculated to be of some assistance to the business man in the carrying on of his daily work. We have been favoured by the Cowan Branch of Messrs. Parkinson and W. & B. Cowan with a handsomely bound pocket-book, which, besides furnishing plenty of space for memoranda of all kinds, includes much information of special utility to gas men. Among other things, there is a table showing the price of gas per 1000 cubic feet at varying quantities per penny and per shilling for prepayment meters; and a page is devoted to setting forth the advantages of retort-house governors. It includes also an insurance policy for £1000. Messrs. Thos. Cash and Co., of Warwick Chambers, Corporation Street, Birmingham, forward a rough notepaper pad conveniently arranged for placing on the desk. The "Mechanical World" Pocket Diary and Year Book for 1909 is to hand. It is published by Messrs. Emmott and Co., of No. 65, King Street, Manchester, at the price of sixpence net; and considering the number of tables and other data to be found in it, one must surely dub it the cheapest book published at the price. Numberless details are given with regard to steam-engines, gas-engines, boiler construction, suction producers, and other matters of importance to all mechanical engineers.

Turning to date blocks and calendars, mention may first be made of that prepared by Messrs. Simon-Carvès, Limited, of No. 20, Mount Street, Manchester, which is a tear-off calendar, with the dates printed in the bold figures which, as in previous years, make it a very welcome gift. On a stiff dark green and gold back, for hanging up, Messrs. Clayton, Son, and Co., of Hunslet, Leeds, send us a calendar with one month on a page, but extending over the next four years; and Messrs. Bale and Church, of No. 5, Crooked Lane, E.C., meet the same requirement for one year. Messrs. Shand, Mason, and Co.'s. Fire Station Calendar for 1909 commemorates the jubilee of their

steam fire-engine; and illustrations show the first brigade "steamer" built by them, with a fireman of that period (1858), and their latest horse-drawn type—the double vertical variable expansion engine, with a fireman of to-day.

We have received from Messrs. Hazell, Watson, and Viney, Limited, of 52, Long Acre, W.C., their useful "Annual" for 1909. This is the twenty-fourth year of issue, and the contents have been revised to meet the changing needs of the times. Among the new matter in the volume are articles on the "Census of Production," "Coal Smoke Abatement," "Co-Partnership and Sir Christopher Furness's Scheme," "Cost of Living and Rates of Wages," &c. The "Annual" appears at a most opportune time—coming at the close of a year which has been fruitful of change, new legislation, and the rapid development of science and invention; and it will prove of great service to everyone who desires to keep in touch with current events. The contents are arranged alphabetically, so that any subject can be easily referred to; and there is a good index. The work has been produced under the editorship of Mr. William Palmer, B.A., whose name has long been associated with it; and it is published at 3s. 6d. net.

Water Supply of Selsey.—Last Saturday week, the Mayor of Chichester (Alderman J. O. Holt), as Chairman of the Selsey Water Company, inaugurated the supply by turning on a hydrant; a commemorative gold key being handed to him on the occasion by a son of Mr. E. O. Preston, one of the originators of the scheme. At a subsequent luncheon, Alderman Holt (who is also Chairman of the Chichester Water Company) remarked that he had opposed proposals made ten years ago, because he wished Chichester to supply Selsey. This, however, had been conceded; and he then had his opportunity of helping the scheme. The Company were getting their supply from Chichester at 6d. per 1000 gallons. It is proposed to tap the first hundred services free, and give with them without charge 30 feet of pipe from the main. During the proceedings, opportunity was taken to present to Mr. J. O. Holt, jun., who acted as Clerk of the Works during the laying of the mains, a handsome silver-plated writing case as a memento.

Coventry Water Supply.—The Water Department of the Coventry Corporation propose adopting a new scale of charges for the supply of water; and in connection with this a statement has been prepared showing the capital expenditure of the department. The capital charges on the new supply are as follows: £32,400 with 60 years' sinking fund, £238; £48,600 with 35 years' sinking fund, £885; interest at 3¼ per cent. on £81,000, £2835; payment to Birmingham (minimum), £5000 annually; maintenance charges, rates, &c., £255—total, £9213. Deduct decreased cost of pumping at Coventry, £900, £8313. New capital for extensions, £8306 with 30 years' sinking fund, £189; interest at 3½ per cent. on £8303, £291; total increased charges, £8793. Deduct average profit for last three years, £4553; leaving a deficiency of £4240. Amount of water-rents for 1907-8, £19,410, 25 per cent., £4852; deduct deficiency, £4240—profit, £612. Adding the decreased costs until the new reservoir is built—viz., sinking fund £238 and interest £1134—there is produced a total of £1984.

The Relighting of Fleet Street.

Referring to this matter on Saturday, the "Daily Telegraph" said: "Notwithstanding the improvements that have been made in recent years in the matter of the widening of Fleet Street, the enormous increase in the traffic which passes through this main artery of the City has made it necessary to bring about yet another alteration in this well-known thoroughfare. Owing mainly to the danger of the skidding motor-bus, which seems to have a *penchant* for lamp-standards, the City authorities have decided to make a new installation of gas-lamps which will project from fancy iron arms attached to the sides of houses—thereby doing away with the standards on the edge of the pavement. The new lamps are of the nature of a trial installation, for the purpose of testing the advantages of high-pressure gas and the Keith light for illuminating purposes." Having given some details of the installation, particulars of which have appeared in the "JOURNAL," our contemporary concluded as follows: "While it is not claimed that this new system is the finest in the world, it is stated that as an illuminant of great power and penetration it is the best known in this country. In addition to supplying the lamps with gas at high pressure, the mains will also be available for the supply of high-pressure gas to offices and works, such as printing offices, &c., where gas is required for smelting purposes, thus avoiding the necessity of installing engines and cylinders for supplying pressure."

Walshaw Dean Reservoir Leakages.—After a great deal of searching, the escape of water from the Halifax Corporation reservoirs at Walshaw Dean has been discovered to be round one end of the heading at the bottom reservoir. Last week the Committee had before them a report from the Engineers, Messrs. George H. Hill and Son, suggesting schemes that might be undertaken to try to stop the leakage. One proposal was that the corner of the reservoir where the escape occurs should be grouted with liquid cement in the hope of blocking-up the passages round the heading; and this the Committee finally decided to adopt. The cost of the work may be £1000. If this is not effective, Messrs. Hill and Son recommend the making of an arm trench at the lower heading, which would cost somewhere about £12,000.

A New Holder at Halstead.—The inauguration of a new holder having a capacity of 110,000 cubic feet at the works of the Halstead Gas Company, Limited, took place on Wednesday, the 16th inst., when Mrs. Brewster, Mrs. P. Adams, and Miss Miller jointly opened the valve giving a direct supply to the town, after which the company sat down to luncheon at the Assembly Rooms. Among those present were the Chairman of the Company (Mr. J. T. Jolliffe) and several Directors, the Secretary and Manager (Mr. F. R. Child), and Mr. S. Cutler (Contractor). The new holder was completed on the previous Friday, when gas was first turned into it by Miss Child. The tank is composed of 89 steel plates. Those forming the sides are 16 ft. 3 in. by 5 ft. 4 in.; and there are 11,103 rivets and bolts. In the holder, there are 446 sheets and 36,208 rivets and bolts. It is stated to be the first holder to be built in England in which the rivets have been clenched by means of compressed air appliances.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 886.

Issue.	Share.	When Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Oct. 15	10	Alliance & Dublin 10 p.c.	18–18⅝	..	5 8 1
268,324	10	,,	7	Do. 7 p.c.	12⅞–13⅛	..	5 5 8
310,000	Stk.	July 15	4	Do. 4 p.c. Deb.	100–102	..	3 18 5
200,000	5	Oct. 29	6⅛	Bombay, Ltd.	5⅝–5⅞	..	5 10 8
40,000	5	,,	6⅛	Do. New, £4 paid	3⅜–4⅛	..	6 6 1
50,000	10	Aug. 27	14	Bourne-mouth Gas and Water } 10 p.c.	29–30	..	4 13 4
51,810	10	,,	7	Do. B 7 p.c.	16⅜–17	..	4 2 4
53,200	10	,,	6	Do. Pref. 6 p.c.	15⅜–16⅛	..	3 13 10
380,000	Stk.	Aug. 13	12½	Brentford Consolidated	245–248	..	5 0 10
300,000	,,	,,	9½	Do. New	187–190	..	5 0 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	122–124	..	4 0 8
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb.	100–102*	..	3 18 5
220,000	Stk.	Sep. 11	10¾	Brighton & Hove Orig.	209–212	+1	5 1 5
246,320	,,	,, 15	7¼	Do. A. Ord. Stk.	152–155	..	5 0 0
450,000	20	Oct. 15	10	British	42½–43⅜	..	4 11 11
109,000	Stk.	Aug. 27	6	Bromley, Ord. 5 p.c.	114–116	..	5 3 5
165,700	,,	,,	4½	Do. do. 3½ p.c.	84–86	..	5 4 8
500,000	10	Oct. 15	7	Buenos Ayres (New) Ltd.	11⅛–11¾	..	5 19 2
250,000	Stk.	Dec. 11	4	Do. 4 p.c. Deb.	92–94*	..	4 5 1
150,000	20	July 15	7½	Cagliari, Ltd.	25½–26½	..	5 9 5
100,000	10	—	—	Cape Town & Dis., Ltd.	4⅛–5⅛	..	—
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	4⅛–5⅛	..	8 3 8
50,000	50	Nov. 3	6	Do. 6 p.c. 1st Mort.	47–49	..	6 2 5
100,000	Stk.	Dec. 11	4½	Do. 4½ p.c. Deb. Stk.	78–80	..	5 12 6
157,150	Stk.	Aug. 13	5	Chester 5 p.c. Ord.	109½–111½	..	4 9 8
1,493,280	Stk.	Aug. 27	5⅝	Commercial 4 p.c Stk.	106–108	..	4 16 4
560,000	,,	,,	5	Do. 3½ p.c. do.	103–105	..	4 15 3
475,000	,,	Dec. 11	3	Do. 3 p.c. Deb. Stk.	81–83*	..	3 12 3
800,000	Stk.	,,	6⅛	Continental Union, Ltd.	105–108*	..	6 0 4
200,000	,,	,,	7	Do. 7 p.c. Pref.	137–140*	..	5 0 0
460,170	Stk.	—	5	Derby Con. Stk.	122–124	..	4 0 8
55,000	,,	—	4	Do. Deb. Stk.	103–105	..	3 16 2
148,995	,,	Sep. 30	5	East Hull 5 p.c. Ord.	98–100	..	5 0 0
486,090	10	July 15	12	European, Ltd.	23⅜–24	..	5 0 0
354,060	10	,,	12	Do. £7 10s. paid	17⅛–17⅜	..	5 1 4
15,182,590	Stk.	Aug 13	4/10/8	Gas-light and Coke } 4 p.c. Ord.	99⅜–100½	..	4 10 2
2,600,000	,,	,,	3⅜	Do. 3½ p.c. max.	89–90	..	3 17 9
3,799,735	,,	,,	4	Do. 4 p.c. Con. Pref.	106–107	..	3 14 9
4,193,975	,,	Dec. 11	3	Do. 3 p.c. Con. Deb.	84⅛–85¼*	..	3 10 2
258,740	Stk.	Sep. 11	4⅜	Hastings & St. L. 3½ p.c.	95–97	..	4 17 11
82,500	,,	,,	6⅜	Do. do. 5 p.c.	113–115	..	5 8 8
70,000	10	Oct. 15	11	Hongkong & China, Ltd.	18–18⅜	..	5 18 11
123,500	Stk.	Sep. 11	6⅛	Ilford "A" and "C"	131–133	..	4 17 9
65,780	,,	,,	5	Do. "B"	103–105	..	4 15 3
51,000	,,	June 26	4	Do. 4 p.c. deb.	104–106	..	3 15 6
4,940,000	Stk.	Nov. 13	5	Imperial Continental	179–181	−1	4 8 5
473,600	Stk.	Aug. 13	3⅜	Do. 3½ p.c. Deb. Red.	95–97	..	3 12 2
195,242	Stk.	Aug. 27	6	Lea Bridge Ord. 5 p.c.	120–122	..	4 18 4
561,000	Stk.	Aug. 27	10	Liverpool United A	226–223	..	4 7 9
718,100	,,	,,	7	Do. B	167–169	..	4 2 10
306,083	,,	June 26	4	Do. Deb. Stk.	106–108	..	3 14 1
75,000	5	Dec. 11	6	Malta & Medn., Ltd.	4⅛–4⅜*	..	6 3 1
560,000	100	Oct. 1	5	Met. of } 5 p.c. Deb.	100–102	..	4 18 0
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	100–102	..	4 8 3
541,920	20	Nov. 13	3½	Monte Video, Ltd.	11½–12	..	5 16 8
1,775,892	Stk.	July 30	4/12/6	Newc'tle & G'tesh'd Con.	109–110	..	4 4 1
418,460	Stk.	June 26	3¼	Do. 3½ p.c. Deb.	92–94	..	3 14 6
15,000	10	Aug. 27	10	North Middlesex 10 p.c.	20–20½	..	4 17 6
55,940	1	,,	7	Do. 7 p.c.	13⅜–14	..	5 0 0
300,000	Stk.	Nov. 27	8	Oriental, Ltd.	139–141	..	5 13 6
60,000	5	Sept. 30	8	Ottoman, Ltd.	6¼–6⅜	..	6 5 6
31,800	53	Aug. 27	13	Portsea Island A	138–140	..	4 18 6
60,000	50	,,	13	Do. B	132–134	..	4 17 0
100,000	50	,,	12	Do. C	122–124	..	4 16 9
114,800	50	,,	10	Do. D and E	104–106	..	4 14 4
398,490	5	Oct. 29	7	Primitiva Ord.	5¼–6	..	5 16 8
796,980	5	July 30	5	Do. 5 p.c. Pref.	5⅛–5⅜	..	4 15 3
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	93–97	+1	4 2 6
1,000,000	10	Oct 15	8	River Plate Ord.	13–13½	..	5 18 6
312,650	Stk.	June 26	4	Do. 4 p.c. Deb.	94–96	..	4 3 4
250,000	10	Sept. 30	8	San Paulo, Ltd.	14–14¼	..	5 12 3
125,000	50	July 1	5	Do. 5 p.c. Deb.	50–51	..	4 18 0
135,000	Stk.	Sept. 11	10	Sheffield A	240–242	..	4 2 8
209,984	,,	,,	10	Do. B	240–242	..	4 2 8
523,500	,,	,,	10	Do. C	240–242	..	4 2 8
70,000	10	Oct. 29	10	South African	13–13½	..	7 8 2
6,429,895	Stk.	Aug. 13	5/6/8	South Met., 4 p.c. Ord.	119½–120½	..	4 8 6
1,895,445	,,	July 15	3	Do. 3 p.c. Deb.	85½–86½	..	3 9 4
209 820	Stk	Aug. 31	8	South Shields Con. Stk.	153–155	..	5 3 3
05,000	Stk.	Aug. 13	5/6/8	S'th Suburb'n Ord, 5 p.c.	117–119	..	4 9 7
60,000	,,	,,	5	Do. 5 p.c. Pref.	121–123	..	4 1 4
117,058	,,	July 15	5	Do. 5 p.c. Deb. Stk.	124–126	..	3 19 4
502,310	Stk.	Nov. 13	5	Southampton Ord.	107–109	..	4 11 9
120,000	Stk.	Aug. 13	6⅜	Tottenham and } A 5 p.c.	134–136	..	4 19 3
398,940	,,	,,	5¼	Edmonton } B 3½ p.c.	106–108	..	4 17 3
149,470	,,	June 26	4	Edmonton } 4 p.c. Deb.	102–104	..	3 16 11
182,380	10	June 12	8	Tuscan, Ltd.	9⅜–9¾	..	8 2 0
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100–101	..	4 19 0
193,742	Stk.	Aug. 27	5	Tynemouth 5 p.c. max.	106–108	..	4 12 7
255,636	Stk.	Aug. 27	6½	Wandsworth and Putney } B 3½ p.c.	128–130	..	5 0 0
79,416	,,	June 26	3	Wandsworth and Putney } 3 p.c. Deb. Stk.	74–76	..	3 18 11
895,872	,,	Aug. 27	5⅛	West Ham 5 p.c. Ord.	112–114	+1	4 9 11
210,000	,,	,,	5	Do. 5 p.c. Pref.	122–124	..	4 0 8
253,300	,,	June 26	4	Do. 4 p.c. Deb. Stk.	105–107	..	3 14 9

Prices marked * are "Ex div."

Swansea Borough Engineer and Private Practice.—For some time past discussion has been going on at Swansea with reference to the alleged engagement in private practice of the Borough Engineer (Mr. R. H. Wyrill) without the knowledge and authority of the Water Committee; and recently Mr. Wyrill was requested to render an account of the moneys so received by him. On Monday of last week, a special meeting of the Water and Sewers Committee was held, to consider this account. The proceedings were private; but afterwards the Press were informed that the statement had been submitted, and that it had been resolved that he be asked to pay into the borough fund the sum of £271 10s. Also that he send a bill to the Llanelly Urban District Council for services rendered to them, and that the amount accruing therefrom be paid to the borough fund.

Coalite Limited New Capital Issue.—At the annual meeting of the Company, a report of which appeared in last week's "JOURNAL," the shareholders in Coalite Limited agreed to an increase in the capital by the creation of the £50,000 new ordinary shares of £1 each; and it was announced that there would also be a further issue of 25,000 deferred shares of 1s. each. The intention was to issue now 25,000 of the ordinary shares and the whole of the additional deferred shares. A meeting to sanction the proposed fresh issue of deferred shares was held last Tuesday, when Mr. Rhys Williams argued that a larger number of deferred shares should be created to make the division of profits fair as between the two classes. He said that if the issue were proceeded with on the suggested basis, he intended to apply to the Courts to restrain the Directors from so doing. The proposition was, however, carried by a very large majority on a poll.

The New Gas-Works at Coventry.—The construction and equipment of the new gas-works which have been established by the Coventry Corporation at Foleshill are now in such an advanced stage that, according to Mr. Fletcher W. Stevenson, the Engineer and General Manager, it is hoped to close down the old works by the end of March, at any rate, so far as manufacturing is concerned. A start with the manufacture of gas at the new works was commenced a few weeks ago, and this has been in steady progress ever since; the object being to accustom the workmen to the new conditions. After the close of the present year, the work will be pursued very vigorously. The cost of the new works amounts to about £200,000. The total area of land acquired is 47 acres; but at present only about one-third of this has been utilized. This means that the Gas Department will be able to produce 5 million cubic feet of gas per day with the plant already installed; but there is ground enough, as already indicated, to admit of treble this quantity being manufactured with the necessary buildings and equipment. The workmen and some of the foremen are being transferred from the old to the new works, where gas will be produced much more cheaply than is possible under present conditions. There is, of course, a substantial amount yet to be paid off the old works. The sum of £50,000 was originally stipulated; and towards this about £15,000 has been provided.

Sale of Shares.—At a sale by auction at Spennymoor last Wednesday, Mr. John Coldwell disposed of a number of shares of £10 each in the Spennymoor and Tudhoe Gas Company at prices ranging from £14 2s. 6d. to £14 per share.

Reduction in Price at Ashbourne.—The Ashbourne Gas Company have written to the Rural District Council stating that it has been decided to reduce the price of gas for power purposes from 2s. 3d. to 2s. per 1000 cubic feet for a stipulated quantity; and for lighting, from 3s. 6d. to 3s. 4d. per 1000 cubic feet, subject to the usual scale of discount. The reduction in both instances, it is announced, will take effect from Jan. 1.

Gas Fatality at Leamington.—An inquest was held at Leamington last week on the body of Joseph Beale, aged 64, a commercial traveller, who died from the effects of coal-gas poisoning. Miss Hayward, of Leam Terrace, said deceased lodged at her house. He had dinner the previous Wednesday night; and when he retired to bed, she was afraid he was the worse for drink. In the morning, her attention was called to a smell of gas from his bedroom; and she and her maid went in. She found the gas-tap turned half on, and immediately turned it off and opened the window. That was about 8.30 a.m.; and the deceased appeared to be sleeping peacefully. She did not think a doctor should be called; but at 11.30 a.m. she sent for Dr. Bury, who came at once. It did not occur to her that the man was dying from gas poisoning at 8.30. The Coroner said he thought witness might have sent for the doctor at once, instead of waiting until 11.30. Dr. Bury stated that he tried every means of restoring the deceased; but he died on the following Friday night. The cause of death was coal-gas poisoning. The Jury returned a verdict of "Death from misadventure."

Administration of Oxygen in Cases of "Gassing."—During an inquest on the body of a man who was poisoned by carbon monoxide at a Sheffield steel-works, Dr. Arthur Connell stated that, however slight a case of poisoning by the gas might be, oxygen should always be administered. It was a matter on which one could not speak too strongly. It such cases, artificial respiration should not be depended upon entirely. The oxygen in the air was not sufficient; and a further quantity must be artificially administered. This was quite easy, and could be done by anybody with the proper appliances. As long as the patient was in the open air, no harm could possibly result from the administration of oxygen. The proper stimulants in such cases were hot meat extracts. Sir William Clegg (who represented the firm) thanked Dr. Connell for his advice, and remarked that the men were frightened to administer oxygen. The works manager, in his evidence, mentioned that about two years ago he obtained a medical opinion as to what was the best treatment in "gassing" cases. Until Dr. Connell's statement at this inquiry, he had not considered it safe for oxygen to be administered except by a medical man. An oxygen cylinder was purchased for use in "gassing" cases; but he would not have used it unless in the presence of a doctor.

Davis's Steamless Radiator

Patent No. 21453.

DAVIS'S STEAMLESS RADIATOR is an absolutely new and original development in Heating Apparatus.

No similar Radiator has previously been made by anyone.

We hold the Patent Rights under Patent No. 21453. Patents have been applied for in all Countries of the World.

It is the only Radiator made which gives even distribution over the whole surface of its columns without the use of complicated Fittings.

It requires no Valves, no attention, simply the Gas connection.

It is absolutely Safe, and is the most Economical method of Heating by Radiation yet invented.

May be seen in operation in our Show-Rooms:

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The Davis Gas Stove Co., Ltd.,

CAMBERWELL, LONDON, S.E.

Christmas Eve Consumption at Tottenham.—The Tottenham and Edmonton Gas Company experienced a busy Christmas Eve; the consumption of gas on that day having reached the record figure of 6,931,000 cubic feet.

The Last Word in Lighting.—The Bournemouth Gas and Water Company are not alone in their appreciation of the usefulness of the excellent pamphlet, entitled "The Last Word in Lighting," the preparation of which to suit local requirements was referred to in the "JOURNAL" for the 22nd inst.; for the Reading Gas Company, among others, may be mentioned as having also adapted it to their own particular needs as an aid to business.

Charge for Gas at Longwood.—Alluding, in the Huddersfield Borough Council, to a minute appointing a Sub-Committee to consider and report upon the question of the purchase of the Longwood Gas-Works, or a revision by the Company of their charges to consumers within the Longwood district, Mr. Riley congratulated the Committee upon having at last taken steps with regard to the anomalous condition of gas charges in the Longwood Ward. Whereas the Corporation supplied ratepayers outside Longwood with gas at 1s. 6d. per 1000 cubic feet, ratepayers in Longwood paid 2s. 9d. for the same quantity to the Longwood Gas Company. This was a very anomalous state of things, and ought not to be permitted. The Mayor (Alderman J. Holroyd) remarked that determined efforts to alter it were made years ago. Mr. Riley replied that he hoped more efforts would be made. The minute was confirmed.

Gas Testing in the Brentford District.—At the last meeting of the Twickenham District Council, the Surveyor reported, through the Pleasure Grounds Committee, that tests of the illuminating power of the gas supplied by the Brentford Gas Company were made at the Queen's Road offices on the 7th and 25th of November, and that the results, corrected for temperature and pressure, were 10·38 and 11·19 candles respectively. A summary of the tests made during October in the various districts represented at the recent conference of local authorities was also submitted; and it appeared therefrom that the highest illuminating power obtained was 12·17 candles at Chiswick on the 17th, and the lowest 10·05 candles at Acton on the 21st. The Council have decided to call the attention of the Hon. Secretary of the conference to the unsatisfactory results of the tests throughout the various districts, and ask what steps are to be taken with respect to the proposed joint application to the Board of Trade on the matter, to which reference was made in the "JOURNAL" for the 24th ult.

Price of Gas at Bingley and Wilsden.—At the monthly meeting of the Bingley Urban District Council, Mr. Metcalfe (one of the Wilsden representatives) asked if the Gas Committee had still under consideration the price the ratepayers in the Wilsden Ward were paying for gas, and whether any steps were being taken to put that part of the district on an equal footing with the remainder. Mr. Towler, the Chairman of the Gas Committee, said the matter was mentioned at nearly every meeting of the Committee; but they got no nearer to a solution. Mr. Metcalfe then asked what objections could be raised to the Bradford Corporation making out the gas accounts for Wilsden at the same rate as the price charged by Bingley, and then the difference between the Bradford charge and the Bingley charge being made good out of the gas profits at Bingley. Mr. Towler said it would be very good, from the Wilsden standpoint, if they could get Bingley to pay their gas bills altogether; but he did not think this would come about. Mr. Brigg (another Wilsden member) thereupon remarked that when Cullingworth was paying a higher price to a private Company for gas than the people of Bingley did, the question was never allowed to rest until the Council bought the Company out.

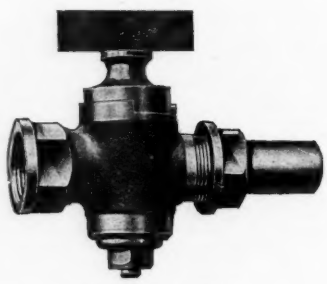
Accident in a Gas-Main Trench at Droitwich.—An inquest was held at Droitwich recently on the body of a gas-fitter named Harrison, whose death occurred under somewhat peculiar circumstances. Deceased, who was in the employ of the Corporation, complained about a month ago that he had been gassed, and that it "seemed to hang in his head." It appeared from the evidence that he and another man were tapping a main, when the escaping gas overcame them both. The Gas Manager (Mr. Frederick Shewering) said that he considered Harrison was a perfectly capable man for the job. He went to inspect the work, and found Price (the second man) coming away ill. Harrison was conscious enough to explain what had happened. He helped Harrison out of the hole, and finished the job. He did not assist him home, because he had to plug an escape of gas. On the following day Harrison made out that he was better than he was. The doctor who attended deceased stated that he came to him complaining of giddiness, unsteadiness of gait, headache, "pins-and-needles" in the right hand, and loss of grip in that hand. He had been "gassed" in May before, and had not been well since the second time it happened in the beginning of November. His speech was thick and indistinct; and there was a partial paralysis at the right angle of the mouth. His pupils were unequal. All the symptoms were consistent with coal-gas poisoning. He would not like to say that deceased would have recovered if he had been treated directly the accident happened. Death ensued as the result of coal-gas poisoning. The Jury returned a verdict in accordance with this evidence.

Last week the Centenary Gas Company received orders for four sets of their air-gas plant, constructed under the patents of Mr. William Key, of Glasgow—a 200-light and a 150-light plant for the Isle of Man, and an 80-light and a 20-light plant for erection in Scotland.

Messrs. John Russell and Co., Limited, forward from their branch at Colston Street, Bristol, a copy of their latest catalogue (season 1909) of gas-fittings, incandescent sundries, outside lamps, &c. Many serviceable and artistic fittings are illustrated—both for inverted and upright burners—and there is also a large selection of globes. Attention may be drawn to the "Vesta-Alma" patent inverted burner, with registered china casing in cream colour with gold decoration. The casing is made in one piece; and the light given by the burner is claimed to be 110 candles for a consumption of less than 4 cubic feet of gas per hour. Both the thumbscrew of the gas-adjuster and the lever of the air-regulator are made of non-heating material.

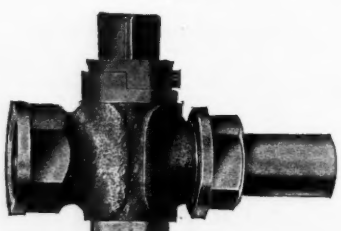
MAIN TAPS

No. 119.



ROUND GASWAY.

No. 61.



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AND SAMPLES.

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Agent for Scotland:
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Situations Wanted.
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CLERK, &c. No. 5036.

Plant, &c. (Second-Hand), for Sale.
ASCENSION PIPES, MOUTHPIECES, &c. Swinton Gas Company.
GASHOLDER. Gas-Works, Pye Bridge, near Alfreton.

Stocks and Shares.
NORTH MIDDLESEX GAS COMPANY. Jan. 19.
SOUTHEND WATER COMPANY. Jan. 19.
SOUTHGATE AND DISTRICT GAS COMPANY. Jan. 19.

TENDERS FOR

Fire-Clay Goods.
BURY CORPORATION. Tenders by Jan. 11.

Meters.
CLACTON URBAN DISTRICT COUNCIL. Tenders by Jan. 13.

Tar.
CLACTON URBAN DISTRICT COUNCIL. Tenders by Jan. 13.
HARWICH GAS COMPANY. Tenders by Jan. 10.

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LARGEST SALE OF ANY OXIDE.

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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
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The one Machine which Discharges and Charges at One Stroke.
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Twice as Rich as Bog Ore.
Gives no back Pressure.
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THE MAXIM PATENT CARBURETTOR.

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See Advertisement on p. 927.
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See illustrated advertisement, Dec. 15, p. I. of Centre.
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(Gas Department.)
WORKS FOREMAN.
WANTED, a Reliable and Experienced Man as GENERAL CARBONIZING and WORKS FOREMAN. Must be well acquainted with up-to-date Plant and Machinery, Carburetted Water Gas and Sulphate of Ammonia Manufacture, and used to Controlling Men.
Wages £3 per Week with House on Works, Coals, Gas, &c.
Applications, stating Age, Experience, &c., to be sent in on or before Jan. 4, 1909, to R. J. Fittall Esq., Town Clerk, Devonport.
William P. Tervet,
Engineer and General Manager.
Gas-Works, Devonport,
Dec. 21, 1908.

FOR SALE—A Gasholder, Single Lift, 60 feet by 20 feet. Capacity, 56,000 Cubic Feet. Must be removed from present site to make room for new Buildings.
Address, B. Ely, Gas-Works, Pye Bridge, Near Alfreton.

TO RETORT AND FIRE-BRICK MANUFACTURERS.
THE Corporation of Bury are prepared to receive TENDERS for RETORTS, FIRE-BRICKS, and FIRE-CLAY required at their Gas-Works.
Forms of Tender may be obtained from Mr. H. Simmonds, Engineer and Manager, Gas-Works, Bury.
Sealed Tenders to be sent to the Town Clerk, Bury, not later than Monday, Jan. 11, 1909.

FOR SALE—5-inch Ascension Pipes, Arch and Dip Pipes, Mouthpieces, &c.
Apply to the Gas Company, Swinton, Yorks.

HARWICH GAS AND COKE COMPANY.
TENDERS are invited for the Surplus TAR produced at this Company's Works for the Year ending Dec. 31, 1909.
The Tar will be delivered free into Railway Tank-Waggons or Tank-Barges at the Works.
Probable quantity, 120 Tons.
The Directors do not bind themselves to accept the highest or any Tender.
Sealed Tenders, to be delivered, addressed to me, not later than the 10th day of January, 1909.
Geo. Baines,
Secretary.

CLACTON URBAN DISTRICT COUNCIL.
TAR.
THE above Council are prepared to re- ceive TENDERS for the Purchase of the Surplus TAR produced at their Gas-Works for the ensuing Twelve Months.
Particulars and Form of Tender may be obtained from Mr. Sydney Francis, A.M.I.M.E., the Council's Engineer, Town Hall, Clacton-on-Sea.
Sealed Tenders, endorsed "Tender for Tar," to be delivered to the undersigned not later than Twelve o'clock noon on Wednesday, Jan. 13, 1909.
The Council do not bind themselves to accept the highest or any Offer.
Geo. T. Lewis,
Clerk to the Council.
Town Hall Buildings,
Clacton-on-Sea.

CLACTON URBAN DISTRICT COUNCIL.
GAS-METERS.
THE above Council are prepared to re- ceive TENDERS for the Supply of Prepayment and Ordinary Dry GAS-METERS.
Full Particulars and Form of Tender may be obtained from Mr. Sydney Francis, A.M.I.M.E., the Council's Engineer, Town Hall, Clacton-on-Sea.
Tenders, sealed and endorsed "Tender for Meters," to be delivered to the undersigned not later than Twelve o'clock noon on Wednesday, Jan. 13, 1909.
The Council do not bind themselves to accept the lowest or any Tender.
Geo. T. Lewis,
Clerk to the Council.
Town Hall Buildings,
Clacton-on Sea.

THE GASLIGHT AND COKE COMPANY.
NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate TO CAPITAL STOCKS, WILL BE CLOSED at Four o'clock p.m., on Tuesday, the 5th day of January next, and WILL BE RE-OPENED immediately after the Half-Yearly Ordinary General Meeting of the Company to be held on Friday, the 5th day of February next.
By order,
Henry Rayner,
Secretary.
Chief Office: Horseferry Road,
Westminster, S.W., Dec. 22, 1908.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.
MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to Messrs. A. & W. Richards, at 18, Finsbury Circus, E.C.

By order of the Directors of the
SOUTHEND WATER-WORKS COMPANY.
NEW ISSUE OF 1050 NEW ORDINARY FIVE PER CENT. MAXIMUM £10 SHARES.
MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, London, E.C., on Tuesday, Jan. 19, at Two o'clock, in Lots of Ten and Five Shares each.
Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
NORTH MIDDLESEX GAS COMPANY.
NEW ISSUE OF £4000 FIVE PER CENT. PREFERENCE STOCK,
AND
£3000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.
MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 19, at Two o'clock, in Lots.
Particulars of the Auctioneers, as above.

By order of the Directors of the
SOUTHGATE AND DISTRICT GAS COMPANY.
NEW ISSUE OF £4500 FIVE PER CENT. PREFERENCE STOCK.
MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 19, at Two o'clock, in Lots.
Particulars of the Auctioneers, as above.

THE SECOND EDITION OF
GAS COMPANIES'
BOOK-KEEPING.
A Practical Treatise on the Keeping of Gas Companies' Accounts.
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BENJAMIN TAYLOR.
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Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.
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RETORTS CAREFULLY PACKED FOR SHIPMENT.

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Sperm Value 878·85 lbs. per Ton.
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LONDON: 16, Park Village East, N.W.

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Highest Results in Gas, & Excellent Coke.
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